INTENSITY CHANGES OF TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC OCEAN DURING 1960-1969

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

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by

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Intensity Changes of Tropical Cyclones in The Western North Pacific Ocean During 1960-1969

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

Six-hourly observations containing 18 parameters of tropical storms and typhoons in the western north Pacific Ocean during the period 1960 through 1969 were examined. The data were composited into four periods: before and after maximum intensity for East-West moving storms, and before and after recurvature for recurving storms.

Monthly and seasonal variations of tropical cyclone intensity, speed of movement and size were examined. Correlation coefficients of the 18 tropical storm and typhoon parameters were computed for each of the four composited periods of study. The four highest correlation values for the past 24-hour change of intensity parameter were checked for levels of significance.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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I. INTRODUCTION

A. HISTORY

Mature tropical cyclones,[1] called hurricanes in the Atlantic and typhoons in the western Pacific, are the most violent large-scale convective systems in the atmosphere. They form over the warm waters of all the tropical oceans except the South Atlantic [Dunn 1964]. Typhoons are neither the largest nor the most intense atmospheric storms, as they cannot compare in size with the winter storms of middle latitudes or match the concentrated winds found in tornadoes. However, the considerable size and great intensity of tropical storms make them the most dangerous and destructive of all storms.

The greatest damage and loss of life due to typhoons arise from storm surges that flood low-lying coastal areas with wind-driven seas, from flooding caused by the heavy rains, and from winds that frequently exceed 150 miles per hour. The great economic impact of these storms amply justifies efforts to study them. Observation of tropical cyclones, however, has not been easy. Prior to World War II, most of the data available for study were based on observations from ships at sea, by observers located on small islands or by a network of meteorological stations after a storm had moved inland. On 27 July

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[1] Tropical cyclonic circulations which at one time in the life cycle of the storm attained either tropical storm or typhoon intensity.

1943, Colonel J. P. Duckworthe made the first planned flight into the eye of a hurricane, proving the feasibility of aircraft reconnaissance of these storms. Routine reconnaissance flights by the Navy and Air Force have since contributed significantly to the detailed knowledge of both the structure and energetic processes of these storms. Measurements of winds, temperatures and pressures obtained during these flights have provided a fairly complete three-dimensional description of tropical storms[2] and typhoons.[3]

The advent of weather satellite pictures of cloud patterns has been of considerable value in synoptic meteorological analysis [Anderson, et al 1966]. These pictures have been of particular importance in remote portions of the oceans where conventional meteorological information may be lacking. In April 1960, for example, Tiros I, an experimental weather satellite, made meteorological history [Dunn 1964], by photographing an unreported fully developed tropical cyclone, located about 800 miles east of Brisbane, Australia. In addition to locating mesoscale weather patterns, the extent and appearance of cloud masses have been interpreted in terms of development or decay of significant synoptic features. Such observations serve as an important supplement to the aircraft reconnaissance data of

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[2] Tropical cyclonic circulations which at one time in the life cycle of the storm attained sustained wind speeds of 34 to 63 knots inclusive.

[3] Tropical cyclonic circulations which at one time in the life cycle of the storm attained sustained wind speeds of 64 knots or more.

tropical cyclones, resulting in a more complete history file of storm information.

B. BACKGROUND

Various methods have been employed to describe the intensity of tropical cyclones in the western north Pacific Ocean. Frank and Jordan [1960] studied the climatological aspects of typhoons, utilizing central pressure data observed during the period 1950-1957. Riehl and Malkus [1961] suggested that the area covered with clouds capable of producing radar echoes varies directly with the intensity of the storm. Later, FUNG Yat-kong [1970] conducted a purely statistical analysis on the intensity of typhoons from 1958-1968, based on the minimum value of central sea level pressure. The extensive paper by Gray [1970] provided an updated statistical climatology of tropical cyclones in the western north Pacific Ocean.

More recently, Riehl [1971] examined recurving typhoons, showing the variation of intensity during recurvature. Brand and Gaya [1971] presented statistical information on the geographical and seasonal variations of tropical cyclone intensity changes, based on 25 years [1945-1969] of data. Finally, Brand [1972] found distinct geographic and seasonal preferences for both rapid intensification and low-latitude weakening of tropical cyclones in the western north Pacific Ocean.

C. OBJECTIVES OF THE STUDY

The above investigations have shown that both a seasonal and geographic variation of tropical cyclone intensity exists.

Moreover, they tend to imply that the variations of intensity may have an important influence on the variation of other tropical cyclone parameters. However, there have been no studies which demonstrate the significance of the variation of tropical cyclone intensity and its relationship to the variation of other tropical cyclone parameters. It is therefore the purpose of this paper to describe:

1. The seasonal variation of tropical cyclone intensity as a function of maximum intensity, speed of movement and storm size.

2. The correlation of the available tropical cyclone parameters both before and after maximum intensity, and before and after recurvature.

D. THE AREA OF STUDY

The tropical western north Pacific Ocean experience more than twice as many tropical storms or cyclones as any other area [Atkinson 1971]. It is also the only region where storms can occur in any month. Table I illustrates the cyclone activity of the past five years [FWC/JTWC 1971], during which era increased satellite coverage proved to be an invaluable aid in the detection of cyclones in the early stages of formation.

Figure 1 is a Mercator projection showing the portion of the western north Pacific Ocean used for this study. Land stations and ship reports are sparse in the western north Pacific Ocean, especially in the areas of tropical cyclone formation. The fixed reporting stations and a typical distribution of daily reports from transiting ships are shown in Fig. 1.

The importance of the area to the Navy is clearly demonstrated in Table II. It lists the number, points of origin and destination of Navy ships, and additional ships under Navy contract, which transited the area during the calendar year 1971. Information concerning the number of non-Navy ships was not available. Not all ships which transit the areas of cyclone genesis report weather, and once the cyclone moves into the shipping lanes, it is usually of such intensity that ships will take evasive action. Because of this lack of data, one of the greatest aids in locating cyclones has been the Automatic Picture Transmission (APT) satellite pictures received via Forecasters Facsimile (FOFAX) [FWC/JTWC 1971]. This additional information helps to augment the available reconnaissance data of tropical cyclones.

TABLE I

A tabulation of tropical cyclone activity in the western north Pacific Ocean, 1967-1971 [FWC/JTWC 1971].

	1967	1968	1969	1970	1971
Total number of warnings	957	822	430	533	747
Calendar days of warnings	185	142	108	127	163
Tropical depressions[4]	6	4	4	3	2
Tropical storms	15	7	6	12	11
Typhoons	20	20	13	12	24
Total tropical cyclones	41	31	23	27	37

[4] A weak tropical cyclone circulation with highest sustained wind speeds (average over one minute or longer period) of less than 34 knots.

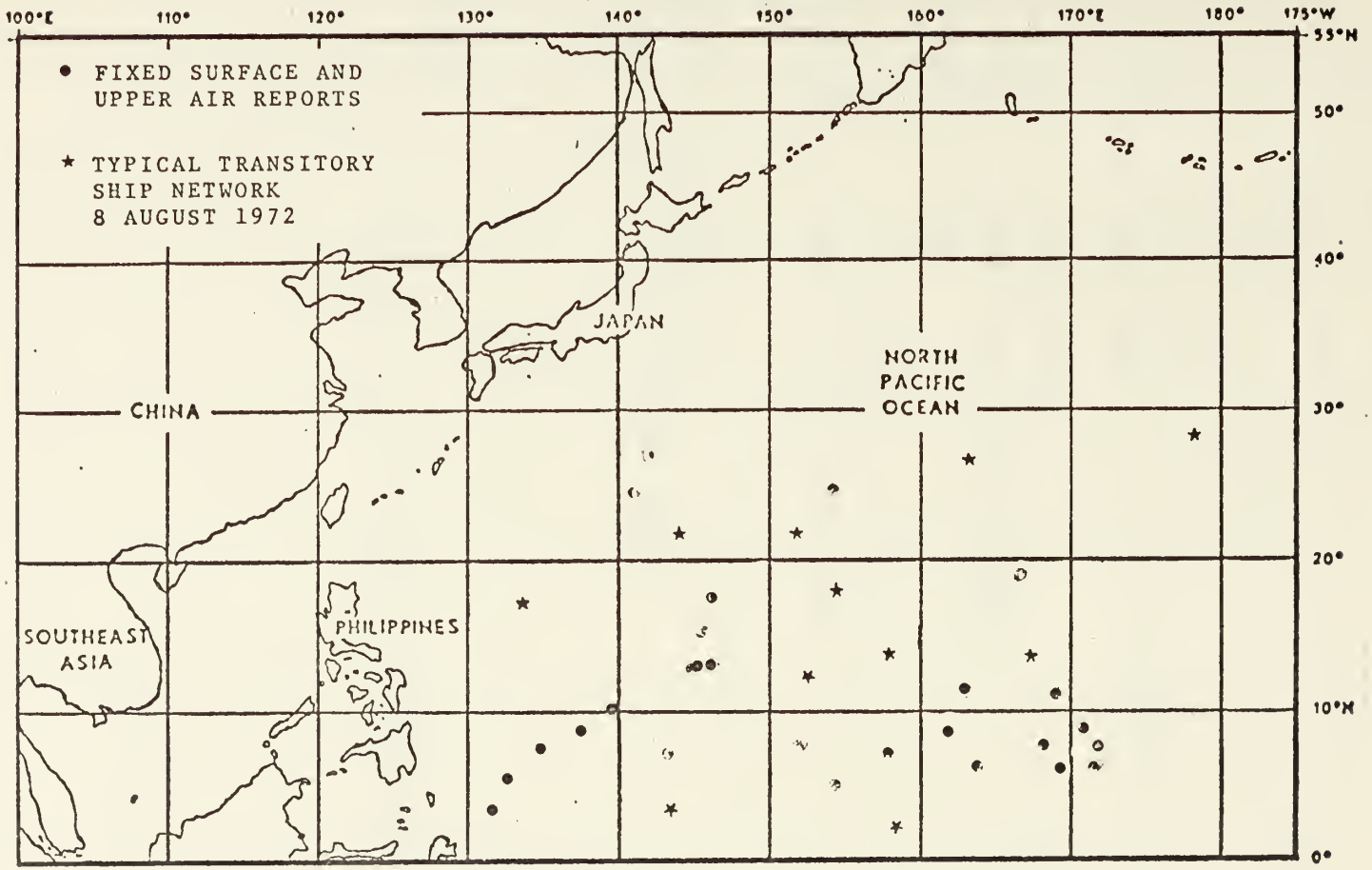

Figure 1. The area of the western north Pacific Ocean used in this study, with fixed and transitory surface observation networks.

TABLE II

A tabulation of the number of ships, either Navy or Navy contract vessels, which transited the western north Pacific Ocean during calendar year 1971 [FNWC 1972].

Ports	Westbound	Eastbound
Washington, Oregon - South China Sea	4	3
Washington, Oregon - Japan, Korea, Okinawa, Taiwan	1	11
Washington, Oregon - Guam	10	13
California - South China Sea	121	65
California - Japan, Korea, Okinawa, Taiwan	41	88
California - Guam	21	16
Canal Zone - South China Sea	96	43
Canal Zone - Japan, Korea, Okinawa, Taiwan	16	50
Canal Zone - Guam	3	12
Hawaii - South China Sea	32	14
Hawaii - Japan, Korea, Okinawa, Taiwan	12	33
Hawaii - Guam	11	15
Sub-totals	368	363
Total	731	

II. DATA

A. DATA SOURCES

The data used for this study were extracted from a file of tropical storms and typhoons of the western north Pacific Ocean, compiled by the National Climatic Center for the Navy Weather Research Facility. The history file was comprised of data from the following sources:

1. Synoptic Charts

Period	Preparing Agency	Location
1/45-12/47	U.S. Air Force Weather Central	Andrews AFB, Md.
1/45- 4/60	U.S. Air Force Weather Central	Tokyo, Japan
7/45-12/45	U.S. Weather Bureau	Washington, D.C.
1/45-12/67	U.S. Air Force, Anderson AFB	Guam, M.I.
5/59-12/66	U.S. Navy, FLEWEACEN/JTWC	Guam, M.I.
1/67-12/69	ESSA, NMC	Washington, D.C.
1/45-12/54	U.S. Navy and U.S. Air Force	Various

2. Publications

Annual Typhoon Reports, Fleet Weather Central/Joint Typhoon. Warning Center, Guam, 1953-1969.

Memoirs of the Central Meteorological Observatory, Japan.

A Report on the Typhoons and Tropical Depressions (Philippines) 1947-1949, 1951-1954, and 1956-1958.

Meteorological Results of Royal Observatory, Hong Kong, 1947-1958.

Typhoons of the Western Pacific, August-October 1945, 7th Amphibious Force Aerological Unit.

Typhoon Reconnaissance-Meteorological Squadron One - May to November 1946, Office of the Chief of Naval Operations, Washington, D.C.

3. Reconnaissance Data

Air Force Reconnaissance Forms, 1947-1968.

Navy Reconnaissance Forms, 1962-1969.

These data sources provided detailed storm-track information. This resulted in the compiled, history file of six-hourly information on the tropical storms and typhoons which occurred during the period 1945 through 1969. For this study the tropical storms and typhoons during the period 1960-1969 were examined, with primary emphasis given to the investigation of storm intensity as a function of other storm parameters.

The following sea-level (and 700-mb where specified) parameters constituted the available data for this paper:

a. Latitude, in degrees and tenths.

b. Longitude, in degrees and tenths.

c. Past 12-hour direction of movement, in degrees.

d. Past 12-hour speed of movement, in knots.

e. Past 24-hour direction of movement, in degrees.

f. Past 24-hour speed of movement, in knots.

g. Size, as the average radius of the outer closed isobar, in whole degrees of latitude.

h. Past 12-hour change of size, in degrees latitude.

i. Minimum observed sea-level pressure, in whole millibars.

j. Past 12-hour change in minimum sea-level pressure, in mb.

k. Maximum intensity (maximum observed wind), in knots.

l. Minimum 700-mb height, in tens of meters.

m. Latitude of the 700-mb ridge north of the storm, in whole degrees.

n. 700-mb height at the ridge line north of the storm, in tens of meters.

o. Longitude at 35N of the nearest 700-mb trough west of the storm, in whole degrees.

p. 700-mb height at the intersection of the trough line at 35N, in tens of meters.

q. Past 12-hour change of intensity, in knots.

r. Past 24-hour change of intensity, in knots.

These 18 data elements were available for each six-hourly observation of the tropical cyclones examined in this study.

III. PROCEDURES AND METHOD OF ANALYSIS

A. PRELIMINARY CRITERIA FOR DATA SELECTION

Following the selection of the area, all the tropical cyclones which occurred during the period 1960 through 1969 were examined. The tracks of these storms are presented in Appendix A. Because of the large variations in the storm tracks, the cyclones were grouped according to the characteristics exhibited by the individual tracks. This analysis resulted in the following representative classifications: (1) East-West moving Storms: Storms that generally proceeded in a westerly direction, having never looped or recurved; (2) Recurving Storms: Storms which experienced a clockwise change in the direction of movement, from an initial westward component to an eastward component; (3) Looping Storms: Storms that illustrated a complete loop in the track, which was formed by the more recent path of the storm crossing its previous track; (4) Northeasterly moving Storms: Storms which generally had an initial northeasterly heading, and which continued to track to the northeast of its initial observation point.

For the purpose of this study, it was decided to investigate only the East-West moving storms and recurving storms, as defined above. Furthermore, each tropical cyclone was required to have at least a 24-hour history, with its genesis having occurred east of 125E. This requirement eliminated the less intense, short-lived storms which would have otherwise biased

the rest of the data. Moreover, a more representative sample of recurving storms was obtained by excluding the recurving storms which had any portion of their tracks west of 125E.

In addition, a storm was not included in this study if its first observation recorded a maximum intensity of the storm greater than 65 knots. Finally, only those continuous track segments which remained over the open ocean were considered. If a storm encountered a land mass such as the Philippines, Taiwan, Japan or the Chinese mainland, its subsequent data were discontinued after the most recent observation prior to landfall. This requirement was imposed in consideration of the recently documented effects of terrain on the behavior of tropical cyclones [Brand 1972].

Table III is a summary, grouped by monthly and half-monthly periods, of the storms which were deleted by the application of the preceding criteria. It shows that of the original 295 tropical cyclones which occurred during 1960-1969, there were 24 which experienced looping and 18 that conformed to the given definition of northeasterly moving storms. Fourteen recurving storms had paths which tracked west of 125E longitude, 11 of which later crossed land. Only five storms had less than a 24-hour history, caused by either the small number of observations made in the storm or the fact that the storm encountered land shortly after the first observation. Another 48 storms that formed west of 125E and five storms that had an initial recorded intensity greater than 65 knots were deleted from the sample.

TABLE III

A listing of the various categories of storms deleted, by monthly and half-monthly periods.

Period	Looping storms	North-easterly storms	Recurving storms with track west of 125E	Less than 24-hour history	Genesis west of 125E	Initial intensity exceeded 65 knots
Jan	1					
Feb					1	
Mar						
Apr		1			2	
May	1	1	2	1	4	
Jun	1	1	2		5	
Jul 1 - 15		1	2		2	
Jul 16- 31	4	3	2	1	4	
Aug 1 - 15	1	4	1		3	
Aug 16- 31	7	2	1		3	1
Sep 1 - 15		1			9	
Sep 16- 30	2		1		2	1
Oct 1 - 15	3	3	1			
Oct 16- 31	2			1	2	1
Nov 1 - 15				1	5	1
Nov 16- 30	2				2	
Dec		1	2	1	4	
Totals	24	18	14	5	48	4

B. DATA UTILIZED

Table IV lists, by monthly periods,[5] the remaining tropical storms and typhoons which were used in this study. The table indicates an August-September peak for tropical storms and typhoons, which compares favorably with the findings of Brand [1972] for the 25-year period 1945-1969. East-West storms also were most frequent in August and September, whereas the largest number of recurving storms was during October.

Figure 2 portrays the monthly frequency distribution of the 3,950 six-hourly observations that remained after excluding those storms that did not satisfy the selection criteria. The maximum number of six-hourly observations occurred in August, and the minimum number in February. It is interesting to notice that even though the month of February had the fewest number of observations, it had a greater number of storms than did the month of January. The reason for this can be realized by examining the storm tracks in Appendix A, which illustrate the variation in the track length, and thus the difference in the number of six-hourly observations.

Another notable feature of Fig. 2 is the limited period during which the largest number of observations occurred. Eighty-three percent of the total number of East-West observations occurred during the period July through November. Seventy-nine percent of the total number of observations in the recurving storms occurred between August and November. Together, these

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[5] Storms are categorized by month according to the midpoint in time of the total storm track.

TABLE IV

Tropical storms and typhoons classified as East-West storms and recurving storms, as separated by monthly periods for the years 1960-1969

Period	Total Tropical Storms and Typhoons per Period	Percent of Total Number of Storms	East-West Storms per Period	Recurving Storms per Period
January	3	2%	1	2
February	4	2	4	0
March	5	3	3	2
April	5	3	3	2
May	4	2	4	0
June	10	6	6	4
July	23	12	21	2
August	38	21	26	12
September	39	21	26	13
October	29	16	9	20
November	18	10	9	9
December	4	2	2	2
Totals	182	100%	114	68

two periods comprised 80 percent of the total number of 1960-1969 six-hourly observations, and are the object of examination in the following sections.

C. ANALYSIS OF EAST-WEST STORMS

The months from July through November for the years 1960-1969 were examined. During this period there were 91 East-West storms, consisting of 1,641 six-hourly observations. The data were separated into two periods within the life cycle of these storms. The first period contained those observations during

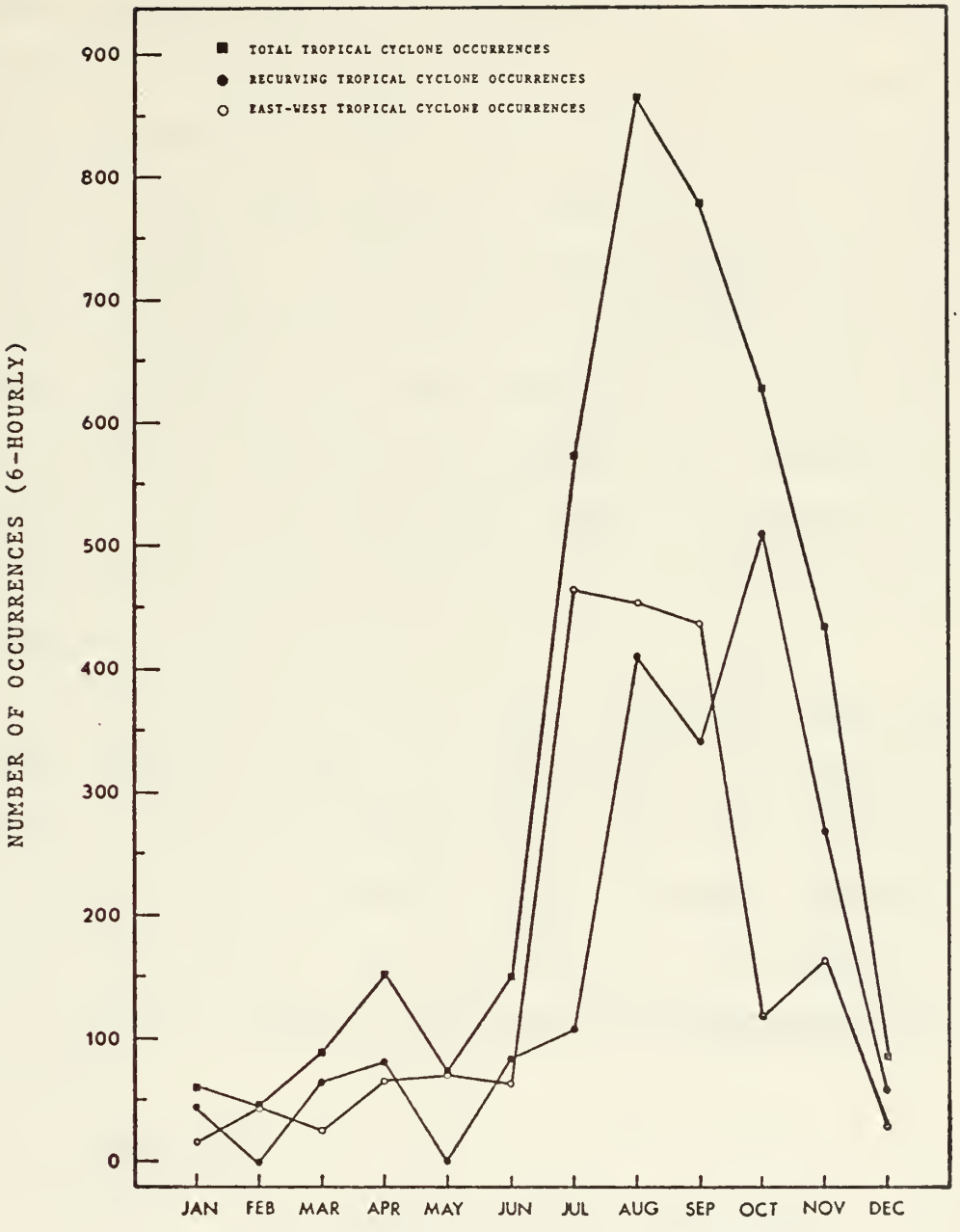

Figure 2. Monthly frequency distribution of tropical cyclone occurrences in the western north Pacific for tropical cyclones which reached tropical storm or typhoon intensity. The occurrences are based on 6-hourly reports during the period 1960-1969. Distributions are also presented for recurving and East-West moving tropical cyclones.

which the storms were intensifying, and included the first six-hourly observation of the maximum intensity. Nine of the East-West storms encountered land prior to reaching maximum intensity. In these cases, the most recent six-hourly observation prior to landfall was treated as the time of maximum intensity. The second period extended from the time the storms started to weaken - or from the second observation of maximum intensity - to the final six-hourly observation of the storms. It should be pointed out that the second period did not include those storms that experienced landfall after reaching maximum intensity. For this reason, the point of maximum intensity is shown as discontinuous in Figs. 3, 4 and 5 to indicate the differences in the sample.

An effort was made to show only the major characteristics of these storms and their relationships to the point of maximum intensity. This was accomplished by plotting for each storm only those averages on either side of maximum intensity which included two-thirds of the sample size at the maximum intensity value. Thus the general character of the parameters was maintained.

1. Intensity

Figure 3 portrays the monthly variation of average intensity relative to the points of maximum intensity (maximum observed wind speed) of 91 East-West tropical storms and typhoons. Tropical storms and typhoons during October were less intense throughout the intensification period, achieving an average maximum intensity of 79 knots. Following maximum intensity,

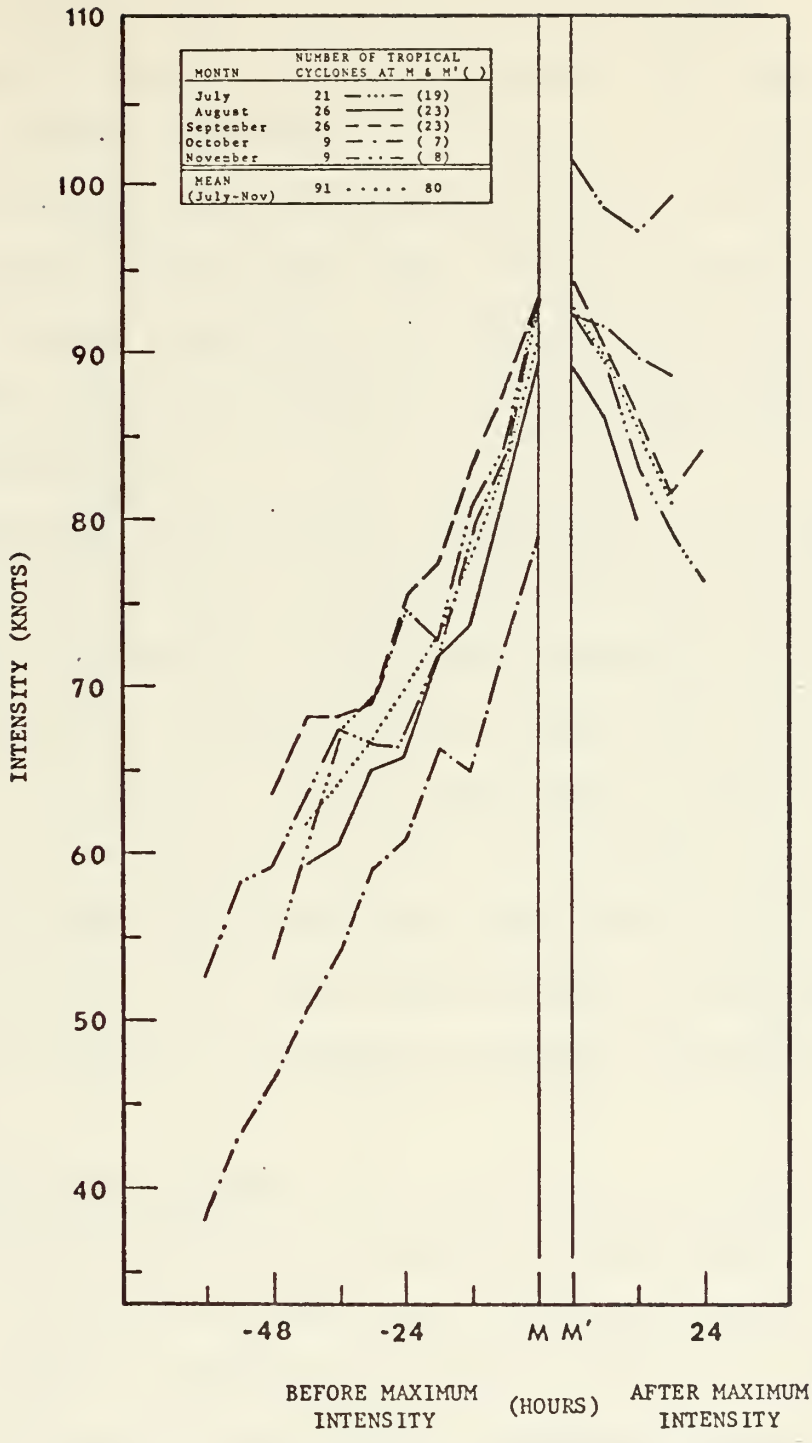

Figure 3. Intensity versus time profiles for east to west moving tropical cyclones (july-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months July through November as well as a mean for the 5-month period. The discontinuity at M and M' exists due to the storms hitting landfall at their maximum intensity.

the October storms were the slowest ones to weaken. In contrast, the month having storms of greatest intensity, reaching an average maximum intensity of 93 knots, was September. During the 24-hour period preceding maximum intensity, the November storms had the most rapid rate of intensification. Following maximum intensity, the November storms were also the most intense, while the storms during July exhibited the fastest rate of dissipation.

Compared to the 10-year weighted mean, the September storms were consistently of greater intensity both before and after maximum intensity. During the intensification period, August and October storms were less intense than the mean of storms for all months. It is of particular interest to notice that during the dissipation period, the earlier season months of July and August had storms that were less intense than the 10-year mean while the later season months of September, October and November had storms of greater intensity than the mean.

2. Speed of Movement

Figure 4 presents the monthly average speed of movement, plotted with respect to the time of maximum intensity of the East-West storms. Although the range of speeds is small, it is significant to note that a distinct monthly variation does exist. Figure 4 shows that October storms reached their maximum speed of movement earlier than storms in other months. At the point of maximum intensity, the October storms had the smallest speed of movement of all months, and experienced a slight increase in speed after maximum intensity.

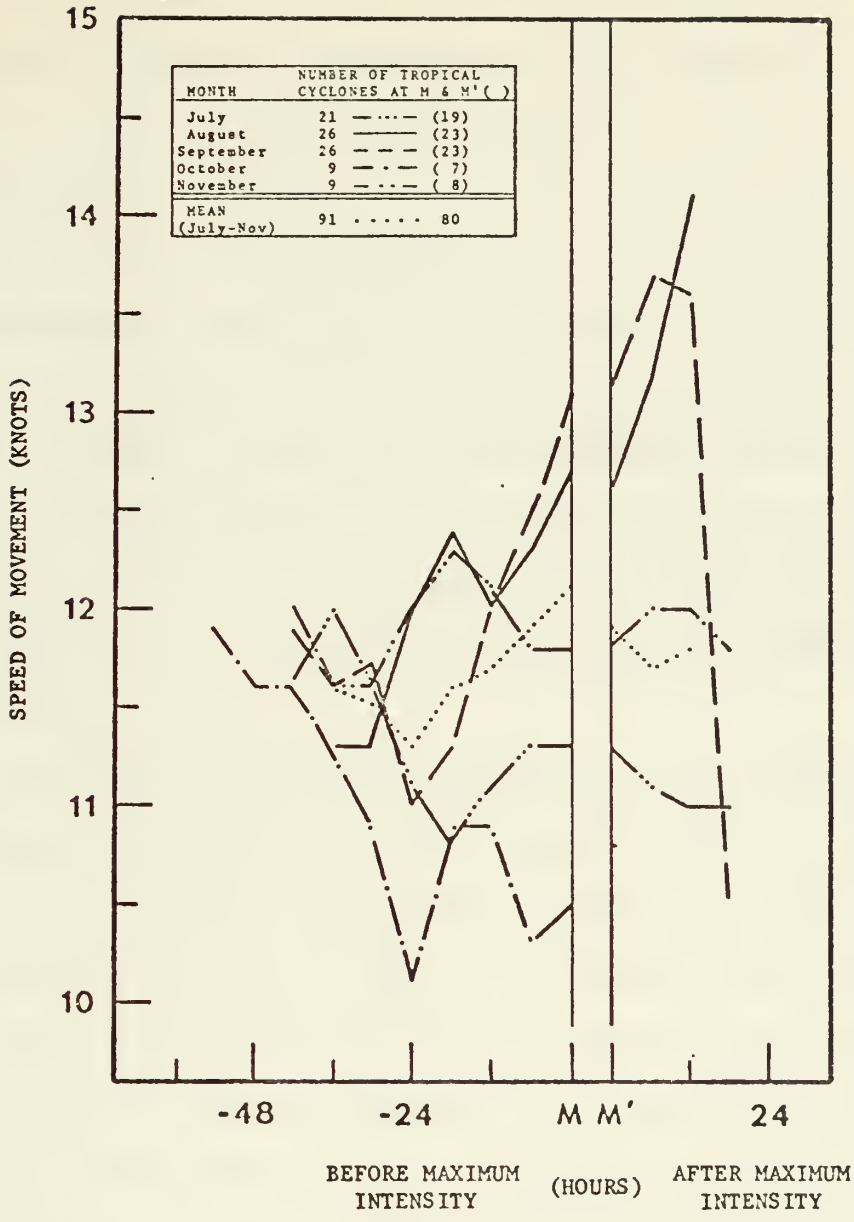

Figure 4. Speed of movement versus time profiles for east to west moving tropical cyclones (July-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months July through November as well as a mean for the 5-month period. The discontinuity at M and M' exists due to the storm hitting landfall at their maximum intensity.

The September storms show a minimum speed of movement at the same six-hourly observation prior to maximum intensity as do the October storms, and the overall average. After this minimum, the September storms demonstrated the greatest increase in speed prior to maximum intensity, at which time they attained the largest speed of movement of all months. Much like the August storms, the September storms showed an increase in speed of movement after maximum intensity. After reaching maximum intensity at about six hours into the dissipation period, the September storms showed a continuous and abrupt decrease in speed, whereas the August storms continued to accelerate.

The speed of movement patterns for the months of July and November were almost exactly opposite, as shown in Fig. 4. The July storms experienced their minimum speed at 18 hours before maximum intensity, when the November storms showed a maximum speed. Furthermore, as the speed of the July storms increased toward maximum intensity, the speed of the November storms decreased. The converse is again seen following maximum intensity. The July storms showed a decrease in speed, the November storms showed an initial increase in speed.

The ten-year mean speed of movement, shown in Fig. 4, shows a minimum speed being reached at about 24 hours preceding maximum intensity, followed by a gradual and continuous increase in speed as the maximum intensity is approached. Following maximum intensity, the mean speed showed a general decrease. Whereas the storms in July, August and September attain maximum

speed of movement either at or following maximum intensity, the storms in October and November reach their maximum speed of movement prior to maximum intensity.

Comparing Figs. 2 and 3 it is seen that a relationship exists between the intensity and the speed of movement. Prior to maximum intensity, the faster moving storms (September) are shown to correspond with those of maximum intensity. Similarly, the slower moving storms (October) correspond with the storms of least intensity. These findings are consistent with those of Shea [1972] who showed that the faster moving hurricanes in the Atlantic Ocean exhibit stronger winds than do the slower moving storms.

3. Storm Size

Figure 5 shows the monthly variation of average storm size[6] plotted with respect to the points of maximum intensity of the East-West storms. August has the smaller tropical storms and typhoons, which reach largest size before maximum intensity and continue to decrease in size afterward. On the other hand, October storms show a dramatic increase in size prior to maximum intensity, and increase to the largest of all months after maximum intensity. The November observations begin as the largest storm size of all months prior to maximum intensity, decrease sharply in size shortly thereafter and later stabilize within 24 hours of maximum intensity with the

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[6] Storm size was defined to be the mean radius in degrees of latitude from the center of the tropical cyclone to the outer closed surface isobar.

MONTH	NUMBER OF TROPICAL CYCLONES AT M & M'( )	
July	21	(19)
August	26	(23)
September	26	(23)
October	9	(7)
November	9	(8)
MEAN (July-Nov)	91	80

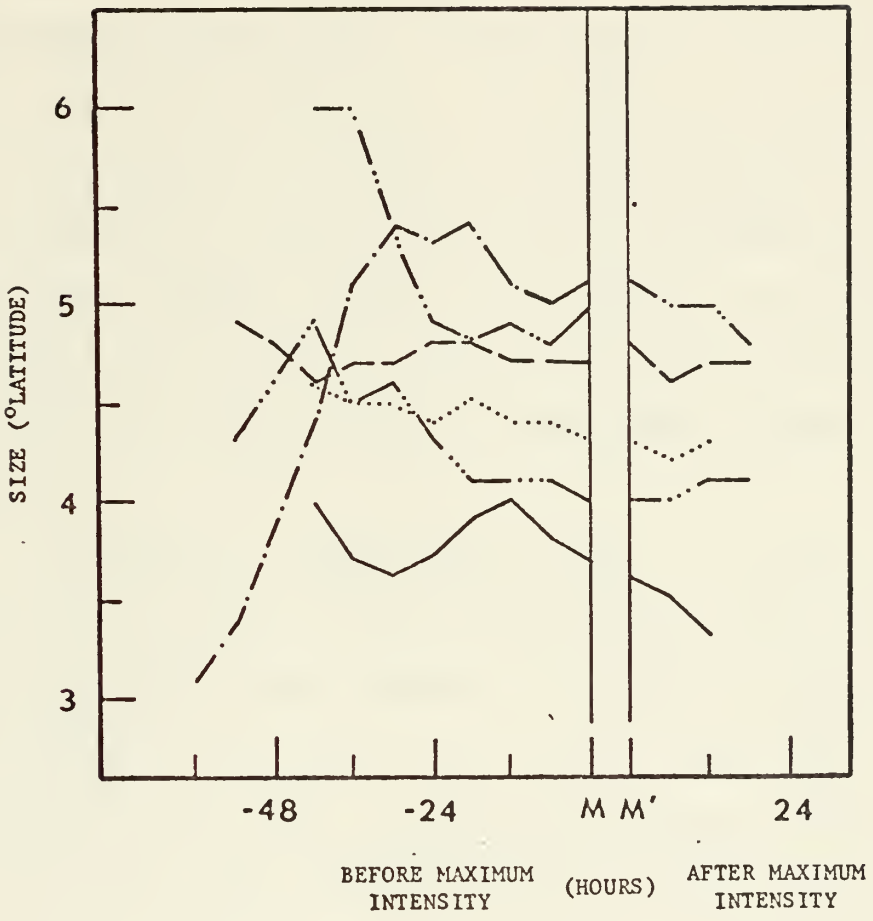

Figure 5. Tropical cyclone size (average radius to outer closed surface isobar in degrees latitude) versus time profiles for east to west moving tropical cyclones (July-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months July through November as well as a mean for the 5-month period. The discontinuity at M and M' exists due to the storms hitting landfall at their maximum intensity.

second-largest storms. In comparison with the other months, the month of September appears generally void of either maximum or minimum extremes in storm size.

In Fig. 5, the 10-year mean storm size for the period July through November shows a monthly stratification within 24 hours of maximum intensity. The distribution of the monthly average size of tropical cyclones as shown in Fig. 5 gives evidence of a seasonal preference for both very large and very small tropical storms and typhoons. The smaller size storms are shown to occur in July and August, and the larger storms during the later months of September, October and November.

In summary, a comparison of Figs. 3, 4 and 5 shows the existence of some definite correlations. While September is the month of the most intense and fastest moving storms prior to maximum intensity, it is not the month that has the largest size storms. It is the least intense, slower moving storms of October which are the largest storms. The more intense, faster moving storms of August are the smallest size storms.

After maximum intensity, the least intense storms of August continue to be the fastest moving storms, as well as the smallest. The more intense storms of the later season (September, October and November) tend to be the larger storms.

D. ANALYSIS OF RECURVING STORMS

The months of August through November for the years 1960-1969 were examined. This four-month period included 54

recurving storms, accounting for 1,535 six-hourly observations. As was the case for the East-West storms, the six-hourly observations were plotted relative to the point of maximum intensity. The data were separately composited during two other periods. The first composite covered the period prior to the point of recurvature.[7] The second composite covered the period extending from the point of recurvature to the last six-hourly observation.

The criterion used for plotting the singular six-hourly observations of the recurving storms was that only those averages which included two-thirds of the sample size at the point of recurvature were plotted on either side of the point of recurvature. Utilizing this method, the major characteristics of the recurving storms as related to the point of recurvature were displayed.

1. Intensity

Curves portraying the average monthly variation of intensity prior and subsequent to maximum intensity of the recurving storms are presented in Fig. 6. A survey of Fig. 6 reveals a few salient facts. For the recurving storms, a much greater number of six-hourly observations exists both before and after maximum intensity than for the East-West storms discussed earlier. Furthermore, the number of observations before the point of recurvature was larger than after recurvature. Based

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[7] The observation at which the track of the tropical cyclone demonstrates a clockwise change in the direction of movement, from a westward component to an eastward component.

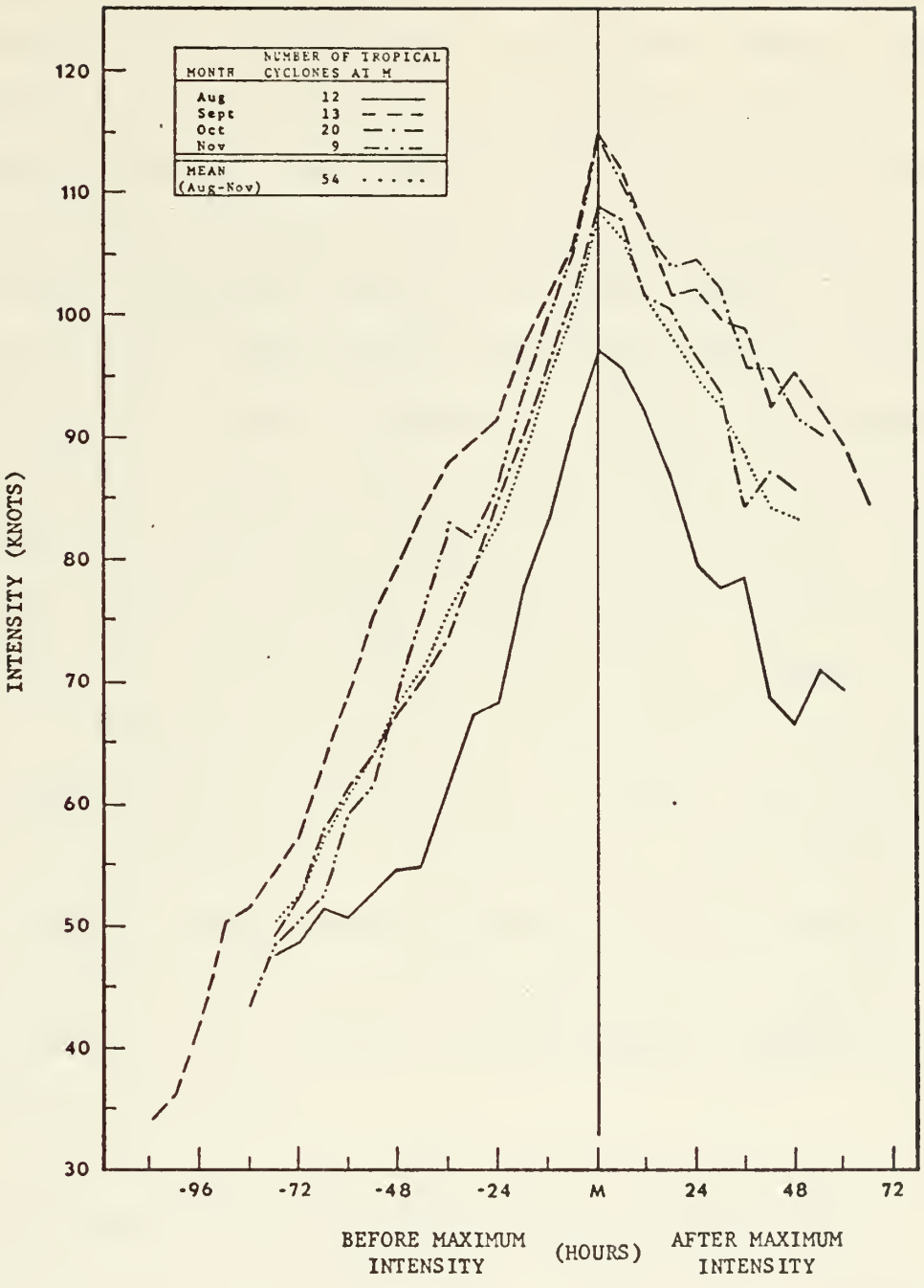

Figure 6. Intensity versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

upon the criterion for inclusion of these values, the profiles indicate that the recurving tropical storms and typhoons were consistently more intense than the East-West moving tropical cyclones during the same month. In addition, September and November storms had the longest tracks before recurvature. The plots further indicate an early seasonal preference for the less intense recurving tropical cyclones, namely, during the month of August. More intense recurving tropical storms and typhoons tend to occur in September, October and November.

Figure 7 shows the variation of the monthly average intensity with respect to the point of recurvature. The September tropical cyclones reached maximum intensity more than two days prior to the point of recurvature. November storms showed a continuous increase in intensity from three days before recurvature up to the point of greatest intensity of all months at 12 hours prior to recurvature. The tropical cyclones during October demonstrated a symmetric bimodal maximum intensity with respect to the time of recurvature, with a relative minimum at recurvature. By contrast, August storms reached peak intensity after recurvature.

For the ten-year weighted mean shown in Fig. 7, the monthly average maximum intensity occurred more than 24 hours prior to the point of recurvature. Riehl [1971] examined the intensity of 66 recurving typhoons for the period 1957-1968 and concluded that virtually all typhoons reached their peak intensity at, or a little before, the point of recurvature and subsequently decreased.

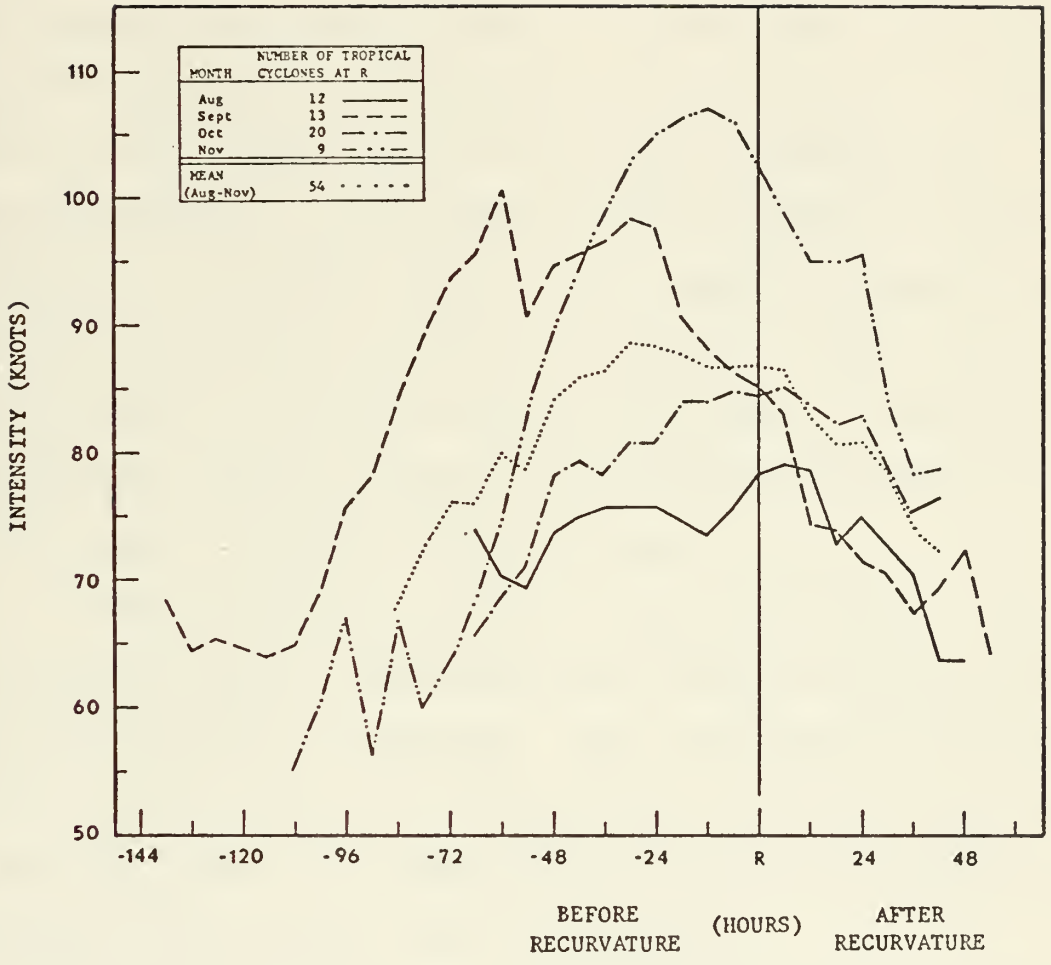

Figure 7. Intensity versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

2. Speed of Movement

The monthly average speed of movement variations are presented in Fig. 8, with respect to the point of recurvature. It is interesting to note that except for September storms, which experienced minimum speed of movement more than three and one-half days before recurvature, all the storms had a minimum speed within 12 hours prior to the time of recurvature. Except during September, all the storms showed a marked acceleration immediately after recurvature. The largest increase in speed following recurvature occurred in November. After a monthly average speed of about ten knots at the point of recurvature, the November tropical storms and typhoons accelerated to an average speed of approximately 27 knots.

Figure 8 further shows the speed of movement after recurvature generally increased with the progression of the season from August to November. This is consistent with the findings of Burroughs and Brand [1972], who further developed forecast equations for predicting the speed of movement of tropical storms and typhoons after recurvature.

Comparing Fig. 8 with Fig. 7 indicated that within 24 hours prior to recurvature, the less intense storms of August and October were also the slower moving storms. The more intense and faster moving storms occurred in September and November. Of particular interest is the fact that the most intense storms of November experienced their maximum intensity just six hours before reaching their minimum speed of movement. After recurvature, November storms had both the most intense and fastest moving tropical storms and typhoons.

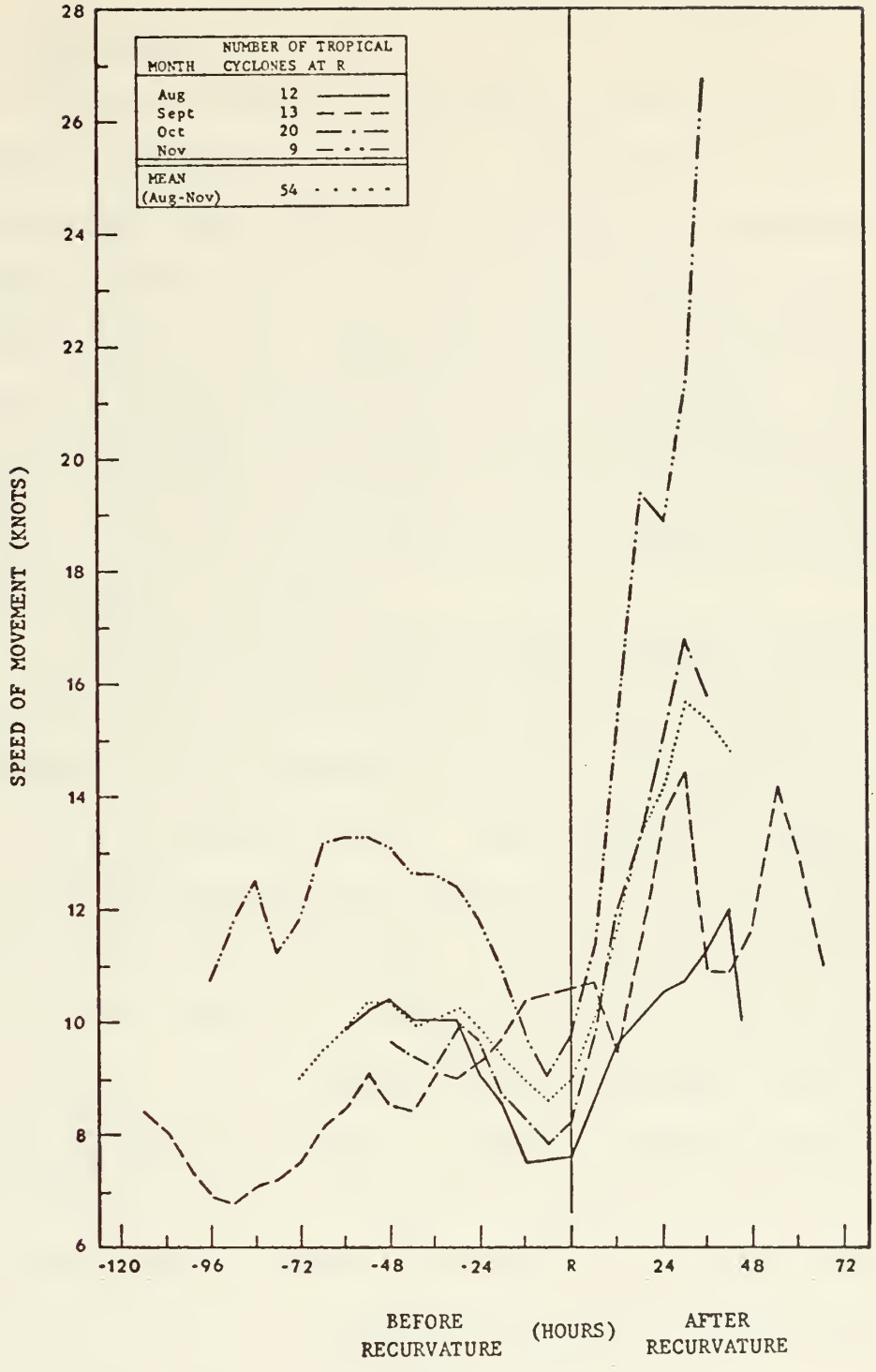

Figure 8. Speed of movement versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

3. Storm Size

Figure 9 shows the variation of the monthly storm size for recurving tropical cyclones. Furthermore, Fig. 9 shows that both very large and very small tropical storms and typhoons have seasonal preferences. The earlier season storms of August were the smaller ones. The maximum size of August storms occurred two and one-half days before recurvature. After this time, they generally decreased in size until six hours prior to recurving, at which time they began to steadily increase in size for another 30 hours.

In comparison with the 10-year weighted mean, Fig. 9 clearly shows that within two days prior to recurvature, August and November had the smaller storms whereas September and October had the larger storms. The summing of opposite tendencies in the different months resulted in a rather flat curve of no significant size variations. From August to October, there appears to be a definite preference for the larger storms later in the season. The October storms had minimum size two and one-half days before recurvature. Then the storms increased in size and reached the maximum size of all months at 30 hours before recurvature. After interim fluctuations in size, the October storms again reached the same maximum size at six hours before recurvature and at 24 hours after recurvature.

The September storms attained maximum size 30 hours prior to recurving, and generally decreased in size thereafter, as shown in Fig. 9. November had a maximum storm size more than three and one-half days before recurvature, then decreased to a minimum size 12 hours before recurvature. The November storms

Figure 9. Tropical cyclone size (average radius to outer closed surface isobar in degrees latitude) versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

then increased in size through recurvature to reach a smaller, secondary maximum 18 hours after recurvature.

The seasonal variation of the parameters for recurving storms, as shown in Figs. 7, 8 and 9, suggest several interrelationships. Prior to the point of recurvature, the less intense, slower moving tropical storms and typhoons of August were observed as also the smallest storms. The more intense storms of September and November were also the faster moving storms, but were not the largest storms. The August storms displayed practically the same characteristics after recurvature as they did before recurvature; they continued in time as the least intense, slowest moving and smallest storms of the period studied.

E. COMPARISON OF THE 10-YEAR WEIGHTED MEANS OF EAST-WEST AND RECURVING STORMS

For ease of comparison the 10-year weighted means of storm intensity, speed of movement and size are presented for the East-West and recurving storms in Figs. 10 and 11, respectively. During the period 48 to 24 hours prior to maximum intensity, the average of the East-West storms (Fig. 10), showed a decrease in speed of movement while intensifying. In the final 24 hours before reaching maximum intensity, the East-West storms accelerated. Furthermore, the East-West storms tended to generally decrease in size throughout both the intensification and dissipation periods.

In the mean, the maximum intensity of the recurving storms (Fig. 11), was reached 21 hours prior to recurvature. The mean

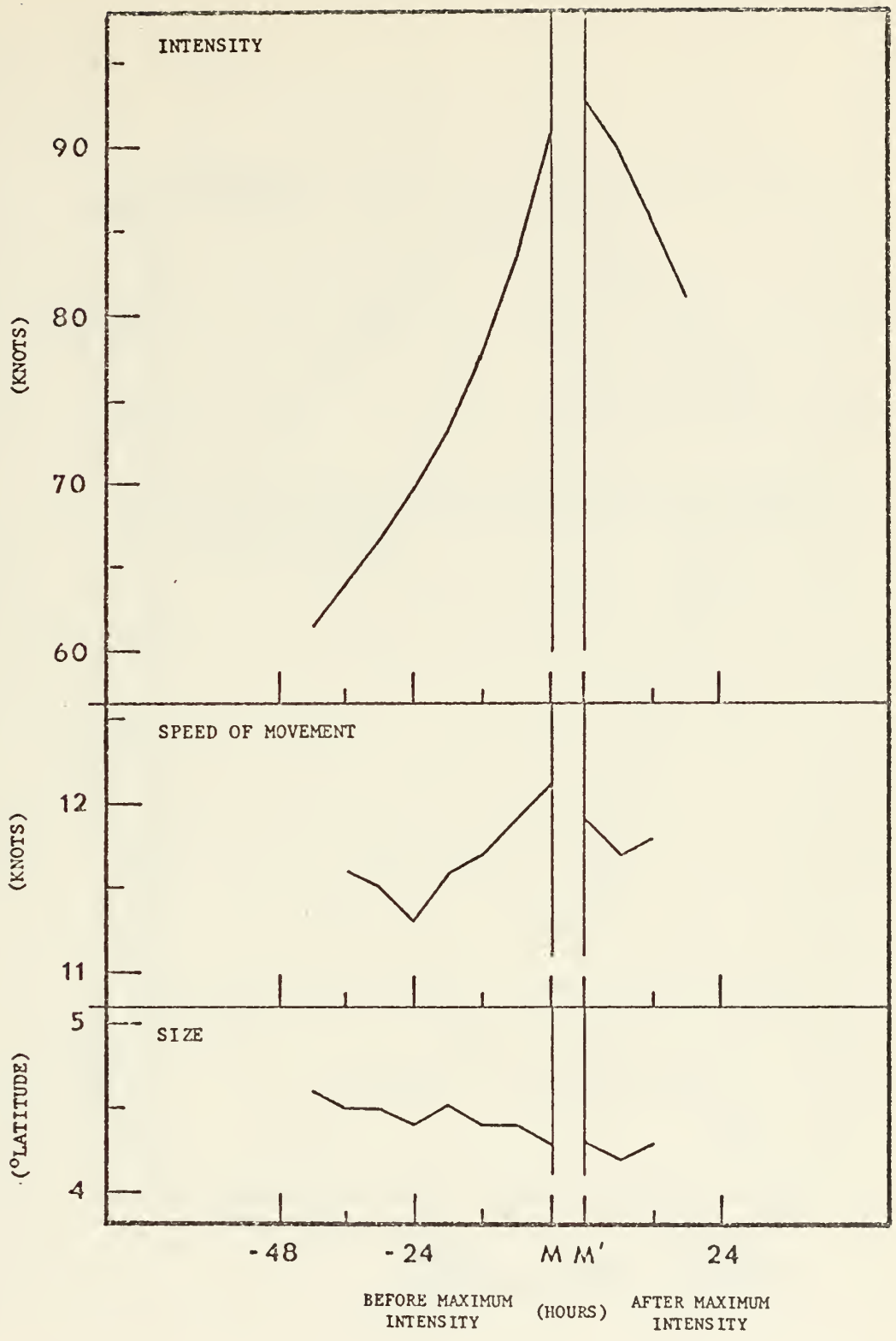

Figure 10. Comparison of the mean intensity, speed and size profiles for the east to west moving tropical cyclones (July-November, 1960-1969) relative to the point at which the storms reach their maximum intensity.

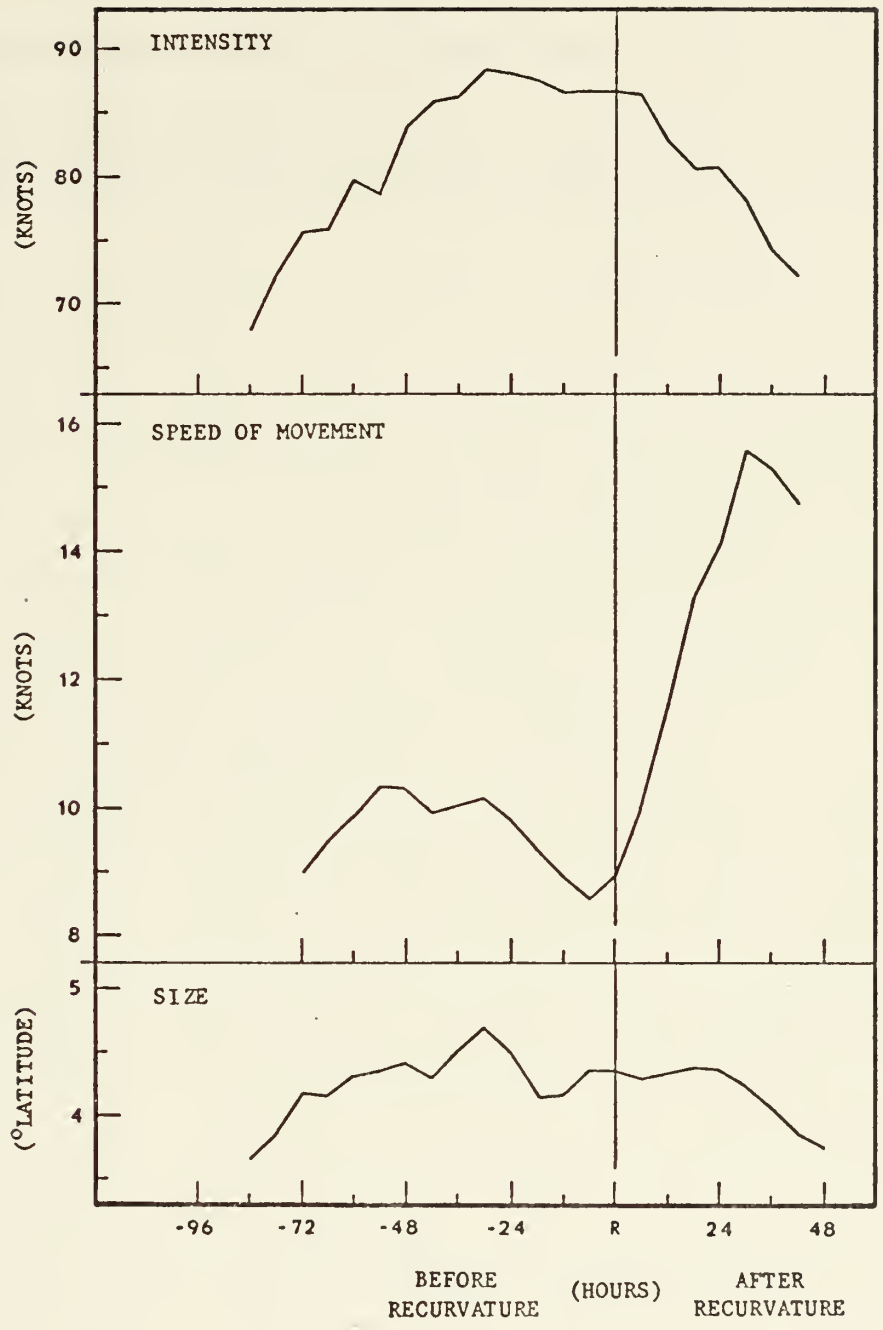

Figure 11. Comparison of the mean intensity, speed and size profiles for the recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature.

speed of movement showed a minimum speed six hours before recurvature, with continued acceleration thereafter until the maximum speed was reached at 30 hours after recurvature. After attaining maximum size at 30 hours before recurvature, the recurving storms showed an overall decrease in size afterward, with very little variation through the time of recurvature.

IV. STATISTICAL CALCULATIONS

The computer program used in this study for developing the tables in Appendices B and C was from the Biomedical (BMD 02R) programs [Dixon, 1966]. This program is currently on file at the Statistical Library of the W. R. Church Computer Facility at the Naval Postgraduate School.

Appendices B and C present statistical correlations for the East-West and recurving tropical storms and typhoons data examined earlier in this study. Each table lists the means, standard deviations and correlations of the eighteen available tropical cyclone parameters. The code explanations are:

(1)	LAT	latitude, in degrees
(2)	LONG	longitude, in degrees
(3)	12 DIR	past 12-hour direction of movement, in degrees
(4)	12 SPD	past 12-hour speed of movement, in knots
(5)	24 DIR	past 24-hour direction of movement, in degrees
(6)	24 SPD	past 24-hour speed of movement, in knots
(7)	SIZE	the average radius of the outer closed isobar, in degrees of latitude
(8)	12 C SIZ	past 12-hour change of size, in degrees latitude
(9)	SLP	minimum observed sea-level pressure, in millibars
(10)	12 C SLP	past 12-hour change in minimum sea-level pressure, in mb
(11)	MAX I	maximum intensity (maximum observed wind speed), in knots
(12)	MIN 7 HT	minimum 700-mb height, in tens of meters

(13)	7 R LT	latitude of the 700-mb ridge north of the storm, in degrees
(14)	7 R HT	700-mb height at the ridge true north of the storm, in tens of meters
(15)	7 T LONG	longitude at 35N, of the nearest 700-mb trough west of the storm, in degrees
(16)	7 T HT	700-mb height at the intersection of the trough line at 35N, in tens of meters
(17)	12 C I	past 12-hour change of intensity, in knots
(18)	24 C I	past 24-hour change of intensity, in knots

A. THE CORRELATION COEFFICIENT

The various measures of correlation indicate the degree of association between the various parameters. The product-moment correlation coefficient represents the degree of linear relationship between any two variables. Because the correlations are based on data over a 10-year period, the results are generally representative.

Since successive data are usually positively correlated (due to persistence), an adjustment should be made to the total number of six-hourly observations for interpretation of the significance of correlation data. Panofsky and Brier [1958] pointed out that, approximately, each observation is independent of the observation three days prior. However, within a tropical cyclone, a complete exchange of mass occurs within 24 hours. Therefore, with four six-hourly observations per day, the number of six-hourly observations (at the top of each table) must be divided by four, yielding the effective number of independent observations, N.

1. Tests of Significance of r

The only requirement for computation of the correlation coefficient, r, for a given sample is that the values of the variables in the sample be truly quantitative. A positive value of r is obtained whenever the relationship between the two variables is such that one of the variables tends to increase if the other variable increases. On the other hand, a negative value of r results whenever the relationship between the two variables is such that one of the variables tends to decrease if the other variable increases.

To test the significance of a correlation coefficient between any two of the variables, one must decide whether or not the value of r calculated from a sample is significantly different from the population value $\rho=0$. The decision is whether or not to reject the null hypothesis, H_0, that the value of ρ is zero, and accept the alternative, H_A, that ρ is different from zero. Table V contains the smallest values of $|r|$ that may be considered significantly different from zero for three levels of significance and for various values of N.

To illustrate the use of these statistical concepts in this study, the following example is given. Consider an observed correlation coefficient, r=.411, and a sample size[8] N=23. The test of H_0: $\rho=0$, H_A: $\rho\neq0$ is made from Table V using the values in the columns under 10%, 5%, and 1% in the row for N=23. Under 5%, the number 0.396 is tabulated. Thus there are only five chances in 100 that a value of $|r|$ larger

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[8] N is the effective number of independent data pairs.

TABLE V

Tabulation of correlation coefficients at the 10%, 5% and 1% levels of significance.

N	10%	5%	1%	N	10%	5%	1%
1	.988	.997	1.000	23	.335	.396	.505
2	.900	.950	.990	24	.329	.388	.496
3	.805	.878	.959	25	.323	.381	.487
4	.729	.811	.917	26	.317	.374	.478
5	.669	.754	.874	27	.311	.367	.470
6	.622	.707	.834	28	.306	.361	.463
7	.582	.666	.798	29	.301	.355	.456
8	.549	.632	.765	30	.296	.349	.449
9	.521	.602	.735	35	.275	.325	.418
10	.497	.576	.708	40	.257	.304	.393
11	.476	.553	.684	45	.293	.288	.372
12	.458	.532	.661	50	.231	.273	.354
13	.441	.514	.641	60	.211	.250	.325
14	.426	.497	.623	70	.195	.232	.302
15	.412	.482	.606	80	.183	.217	.283
16	.400	.468	.590	90	.173	.205	.267
17	.389	.456	.575	100	.164	.195	.254
18	.378	.444	.561	125	.156	.174	.228
19	.369	.433	.549	150	.143	.159	.208
20	.360	.423	.537	200	.125	.138	.181
22	.383	.404	.515	300	.103	.113	.148

than 0.396 would occur by pure chance in drawing an independent sample of 23 observations from a population, in which there really is no linear relationship between the two variables. In other words, 0.396 is the smallest value of $|r|$ that can be considered significant at the 5% significance level for 23 independent observations of two variables. Because the observed value, 0.411, of r is larger than the value in Table V, 0.396, it is concluded that the value of r computed from the sample is significantly different from zero at the 5% significance level. Therefore, the null hypothesis H_0, that there is no linear relation between the two variables, is rejected.

Furthermore, notice that the tabulated value on the line for N=23 in the column under 1% is 0.505. Since the observed value of r=0.411 is less than the table value 0.505, it is concluded that the observed value is significantly different from the population value $\rho=0$ at the 10% and 5% levels of significance, but not significantly different from $\rho=0$ at the 1% level.

2. Application to 24-hour Change of Intensity

To further examine the intensity parameter, a summary of the four highest correlation coefficients of parameter 18, the past 24-hour change of intensity, was constructed. This was done as a diagnostic study to look for relationships between the parameters, and to see if these relationships are physically realistic. Tables VI, VII, VIII and IX summarizes these coefficients before and after maximum intensity for East-West storms, and before and after the time of recurvature for

recurving storms. The number within parentheses indicates the variable number, as listed in the previous section. Each correlation coefficient was tested for a 1% level of significance as described above. In those cases for which less than four variables were significant at the 1% level, additional variables were added at the 5% and 10% levels and indicated by asterisks. The correlation coefficients computed from the combined data of all months are given at the bottom of the tables for comparison.

Table VI summarizes the correlation coefficients for the East-West storms during the period before maximum intensity. As could be expected, the past 12-hour change of intensity (parameter 17) was the most frequent as well as the largest correlation coefficient. In fact, it only occurred in the column of the largest correlation coefficient in this table. In most months persistence was quite a good forecast. The explained variance from this parameter alone ranged from about 60% in April and May to 84% in October. In the column of second-largest correlations, maximum intensity (parameter 11) appeared in the five months having the greatest number of six-hourly observations. The 12-hour change in sea-level pressure (parameter 10) occurred the most number of times as the third-largest correlation coefficient, and was a negative value each time. The fourth-largest correlation coefficient column showed the minimum 700-mb height (parameter 12) to occur the most often, although the months having the greatest number of six-hourly observations favored sea-level pressure (parameter 9). Because

TABLE VI

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period before maximum intensity of the East-West tropical storms and typhoons. The number in parantheses denotes the variable number listed at the beginning of Section IV.

PERIOD	1	2	3	4
FEBRUARY	-0.812(10)	0.725(8)**		
MARCH	0.840(3)	0.828(5)		
APRIL	0.782(17)	-0.611(9)**	-0.591(12**	0.546(11)*
MAY	0.775(17)	0.690(3)	0.656(11)	-0.597(10)**
JUNE	0.832(17)	0.625(14)	0.490(1)**	-0.430(7)*
JULY	0.794(17)	0.571(11)	-0.474(7)	-0.470(10,12)
AUGUST	0.857(17)	0.581(11)	-0.986(10)	-0.397(9)
SEPTEMBER	0.876(17)	0.550(11)	-0.536(10)	-0.475(9)
OCTOBER	0.916(17)	0.879(11)	-0.874(10)	-0.820(12)
NOVEMBER	0.908(12)	0.731(11)	-0.620(9)	-0.577(12)
ALL MONTHS	0.846(17)	0.593(11)	-0.491(9)	-0.487(10)

** Significant at the 5% level.

* Significant at the 10% level.

both parameters 9 and 12 are highly correlated with the maximum observed wind speed (parameter 11), which frequently appeared as the second highest correlant, little new information is added by these two parameters.

Table VII shows a summary of the correlation coefficients for the period after maximum intensity of the East-West storms. As was the case for the period before maximum intensity, the past 12-hour change of intensity (parameter 17) occurred most often as the largest correlation coefficient. The 12-hour change of sea-level pressure (parameter 10) appeared more times than any other parameter as the second-largest correlation coefficient, and each time it was a negative value. As shown in Table VII, there were no correlation coefficients with values significant at the 1% level in the columns of the third- and fourth-largest values of r. This agrees with the results obtained in the sample for all months combined, and implies that it is more difficult to accurately forecast, by statistical methods, the intensity changes after maximum intensity.

A tabulation of the four largest correlation coefficients for the recurving storms during the period prior to recurvature is shown in Table VIII. The past 12-hour change of intensity (parameter 17) dominated the r values in the column of largest correlation coefficients, although July storm intensity change had the largest correlation coefficient of 0.985 with the storm's latitude (parameter 1). Of the second-largest correlation coefficients, the 12-hour change of sea-level pressure (parameter 10) occurred most frequently. Eight months are

TABLE VII

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period after maximum intensity of the East-West tropical storms and typhoons. The number in parentheses denotes the variable number listed at the beginning of Section IV.

PERIOD	1	2	3	4
JANUARY	0.964(5)**	0.955(3)**	-0.926(9)*	-0.920(12)*
FEBRUARY	0.725(11)**	0.682(17)**		
MARCH	0.829(3)**	0.815(5)**		
APRIL	-0.815(10)**	0.720(11)**	0.713(17)**	-0.693(12)**
MAY	0.852(17)			
JULY	0.780(17)	-0.461(10)	0.326(11)**	-0.304
AUGUST	0.799(17)	-0.586(10)	0.379(11)**	-0.320(9)**
SEPTEMBER	0.738(17)	-0.326(10)**	0.282(2)	0.258(15)*
OCTOBER	0.854(17)	-0.645(10)*		
NOVEMBER	0.742(17)	-0.563(1)**	-0.443(10)*	
DECEMBER	0.973(17)**	-0.926(1)*		
ALL MONTHS	0.768(17)	-0.440(10)	0.199(11)**	0.182(2)**

** Significant at the 5% level.

* Significant at the 10% level.

TABLE VIII

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period before recurvature of the recurving tropical storms and typhoons. The number in parentheses denotes the variable number listed at the beginning of Section IV.

PERIOD	1	2	3	4
JANUARY	0.844(12)**	0.836(16)**	0.747(14)*	0.740(17)*
MARCH	0.947(17)	-0.901(10)	-0.820(13)	-0.739(1)
APRIL	0.787(17)	-0.517(10)**	0.433(16)*	
JUNE	0.918(17)	-0.690(10)	-0.591(12)**	0.586(11)**
JULY	0.985(1)	-0.963(13)	-0.953(10)	-0.938(6)
AUGUST	0.889(17)	-0.683(10)	-0.313(1)**	
SEPTEMBER	0.867(17)	-0.592(10)	-0.477(1)	-0.334(13)
OCTOBER	0.854(17)	-0.703(10)	0.297(11)	0.278(8)**
NOVEMBER	0.866(17)	-0.603(10)		
DECEMBER	0.745(17)	-0.646(7)**		
ALL MONTHS	0.871(17)	-0.641(10)	-0.245(1)	0.177(11)

** Significant at the 5% level.

* Significant at the 10% level.

listed in Table VIII as having a third-largest correlation coefficient significant at least at the 10% level. It is interesting to note that none of these eight months had the same third-largest parameter. These parameters included the 700-mb ridge latitude (parameter 13), the 700-mb ridge height (parameter 14), and the 700-mb trough height (parameter 16). Also of interest is the fact that the computed values of r for all months combined during this period were significant at the 1% level.

Table IX presents the correlation coefficients for the period after recurvature of the recurving storms. Consistent with Tables VI, VII and VIII, the past 12-hour change in intensity (parameter 17) was the most recurrent parameter with the largest correlation coefficients. All values in column one were significant at the 1% level. The 12-hour change of sea-level pressure (parameter 10) appeared most often as the second-largest correlation coefficient during this period. The third-largest correlation coefficient that occurred most frequently was the latitude of the storm (parameter 1). The 700-mb ridge height (parameter 14) had the greatest number of occurrences as the fourth-largest correlation coefficient, but did not occur at the 1% level of significance. As during the period before recurvature (Table VIII), the four largest correlation coefficients for all months combined were all significant at the 1% level.

TABLE IX

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period after recurvature of the recurving tropical storms and typhoons. The number in parentheses denotes the variable number listed at the beginning of Section IV.

PERIOD	1	2	3	4
JANUARY	0.856(17)	-0.820(10)		
MARCH	-0.942(10)	0.813(17)**	-0.718(12)**	-0.717(14)**
JUNE	0.860(17)	-0.746(10)	-0.625(1)**	0.576(14)*
JULY	-0.988(12)	-0.984(6)	-0.979(9)	-0.976(12)
AUGUST	0.840(17)	-0.565(10)	-0.406(1)	0.405(11)
SEPTEMBER	0.726(17)	0.467(12)**	-0.461(10)**	0.436(9)*
OCTOBER	0.887(17)	-0.704(10)	-0.654(1)	-0.464(6)
NOVEMBER	0.766(17)	-0.616(1)	0.578(11)	-0.568(4)
DECEMBER	0.975(17)	0.698(7)	-0.669(1)	
ALL MONTHS	0.817(17)	-0.600(10)	-0.393(6)	-0.391(4)

** Significant at the 5% level.

* Significant at the 10% level.

V. SUMMARY AND CONCLUSIONS

Available tropical cyclone data for a 10-year period were examined. Tropical storm and typhoon tracks which were classified as East-West moving and recurving storms were subjected to the following selection criteria: (1) genesis must occur east of 125E, (2) initial observation of intensity cannot exceed 65 knots, (3) the storm must have at least a 24-hour history, (4) recurving storms can have no portion of their track west of 125E, and (5) if a storm track encountered land, all subsequent data were discontinued after the most recent observation prior to landfall. The application of the above criteria resulted in a data sample consisting only of open-ocean observations.

Analysis of the data revealed significant monthly and seasonal variations of intensity, speed of movement and size. For the East-West moving storms, August storms were the smallest (size defined as the mean radius from the center of the tropical cyclone to the outer closed surface isobar). In addition, the August storms were both less intense and faster moving than the 10-year weighted means. The most intense and fastest moving East-West tropical cyclones occurred in September. October had the largest size East-West storms. The October storms were also the least intense and slowest moving East-West storms.

The recurving storms data showed August to have the least intense, slowest moving and smallest size storms. October had the largest size recurving storms. The most intense and fastest moving recurving storms occurred in November.

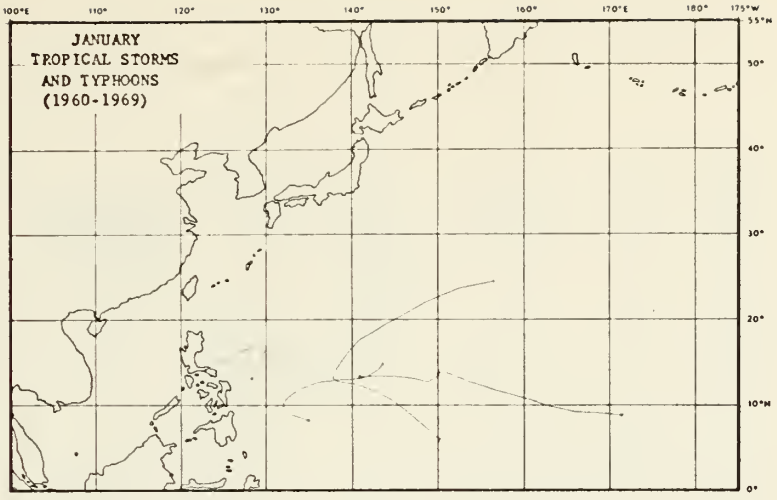
The monthly correlations between 18 parameters of tropical storm and typhoon data were computed for four composited periods: before and after maximum intensity of East-West storms, and before and after recurvature for recurving storms. In particular the correlation coefficients of the past 24-hour change of intensity were examined. The four highest correlation values for each monthly period were checked for significance at the 1%, 5%, and 10% levels. Persistence was shown to be a dominant factor in the East-West storms, with very high significance. In those months in which the storms develop and decay more rapidly, the effective contribution of persistence was less, as expected. It was then that various other parameters appeared as significant correlates.

Further study of intensity changes of the tropical cyclones is suggested. By using a similar data base to correlate current values and tendencies in the tropical cyclone parameters with subsequent intensity changes, regression equations could be developed. The information gained would be of great usefulness to the tropical meteorologist who presently has limited aids to forecast tropical cyclone development and decay.

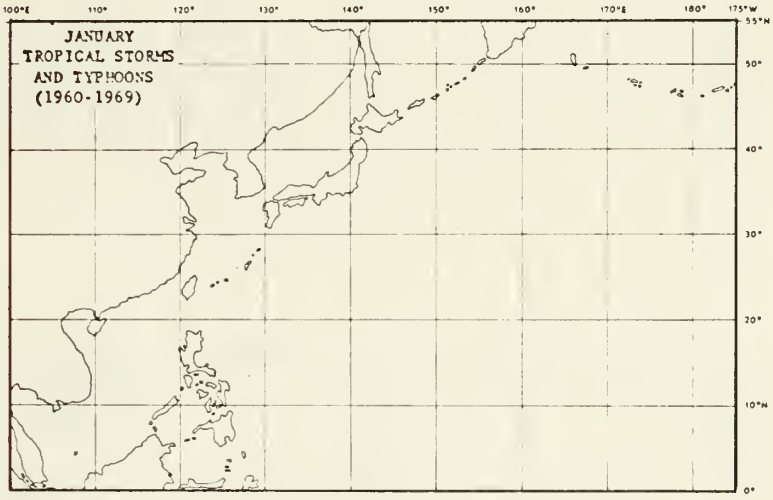
APPENDIX A

Tracks of the tropical storms and typhoons during the period 1960 through 1969 are presented by monthly and half-monthly periods. Complete tracks of ten years storm data are compared with the East-West and recurving storms used in this study.

(a)



(b)



(c)

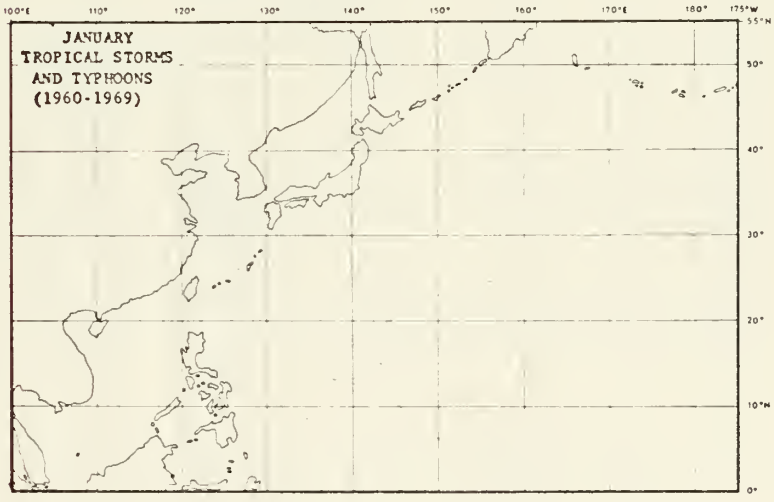
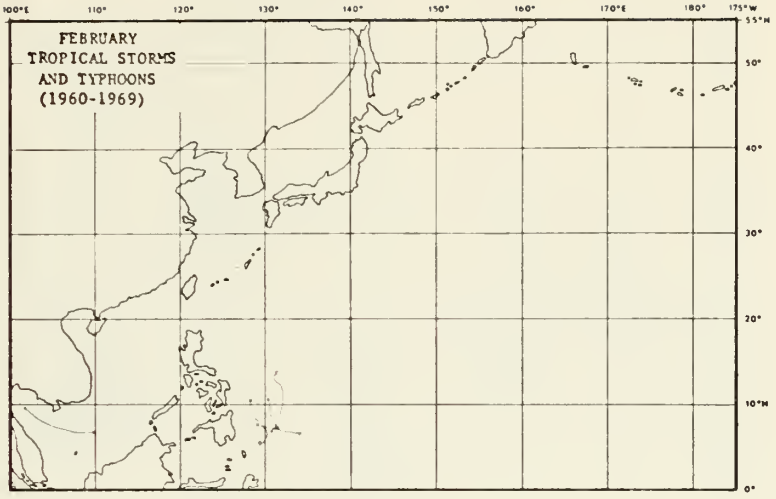


Figure 12. January tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)

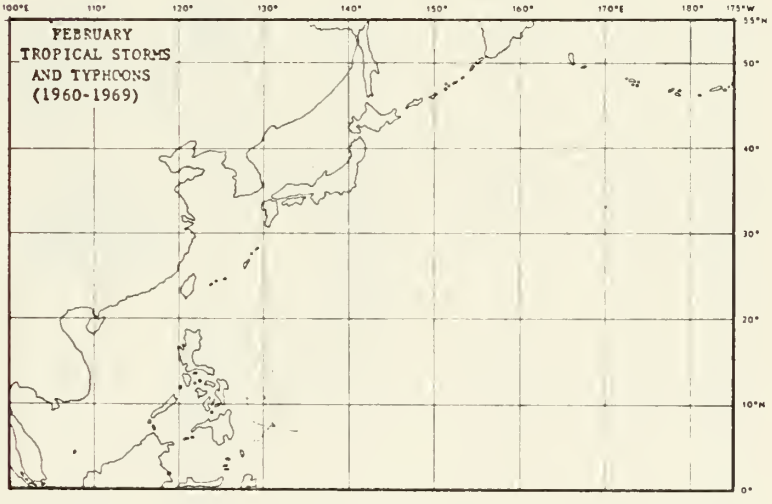
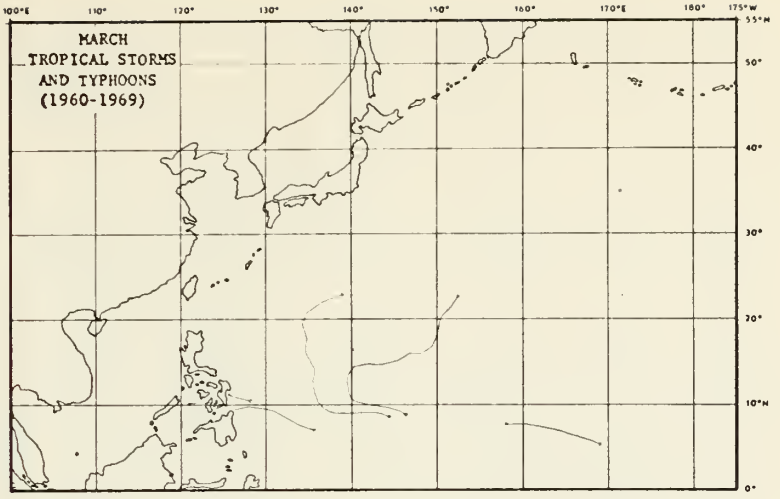
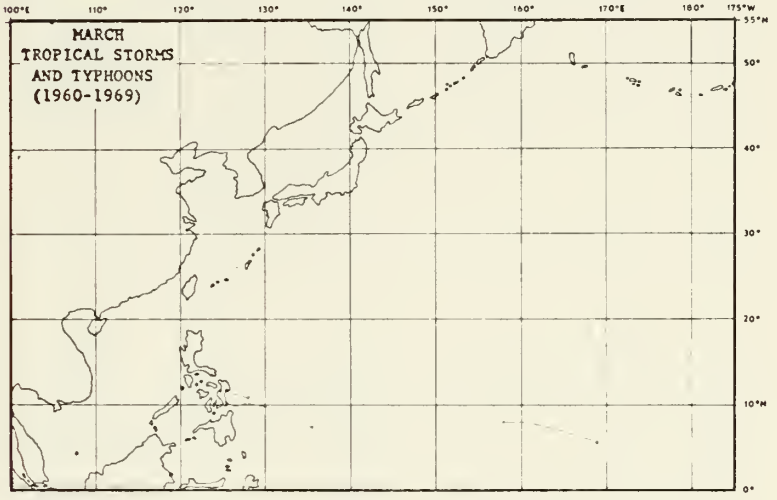


Figure 13. February tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) and the track segments of East-West storms (b) examined in this study.

(a)



(b)



(c)

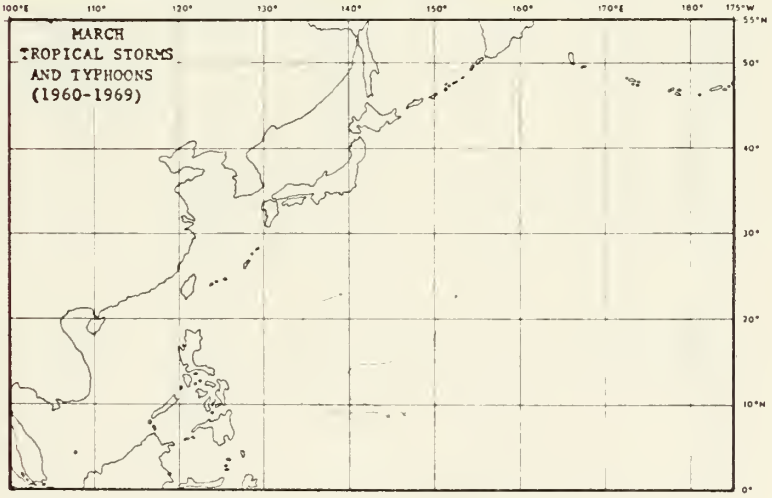
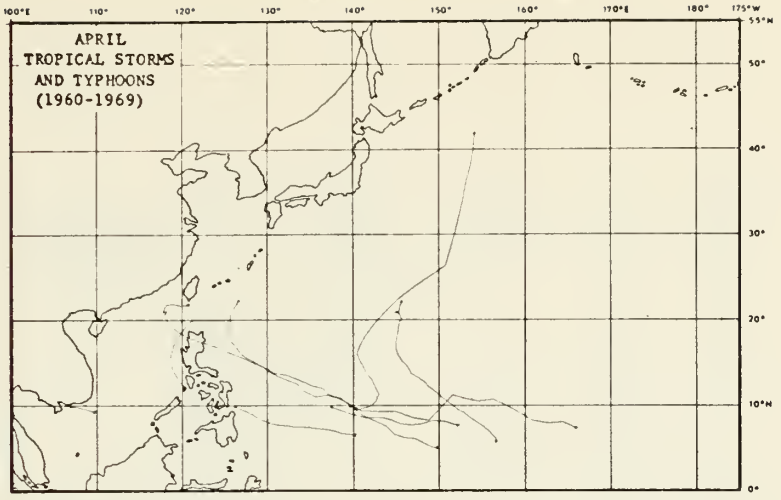
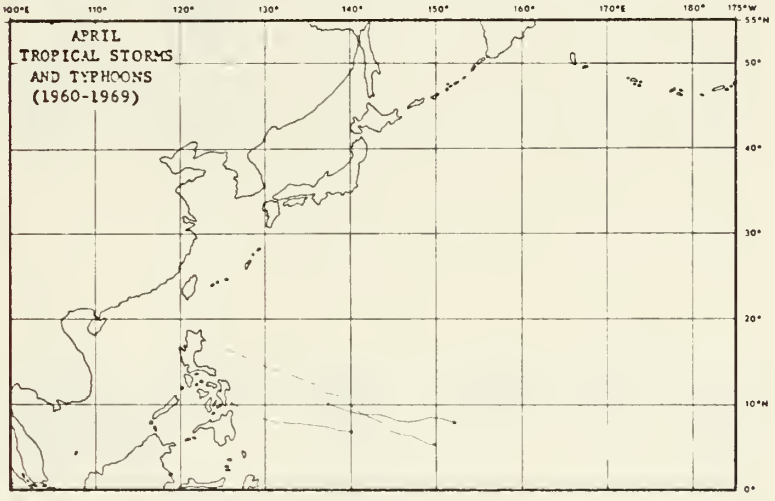


Figure 14. March tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

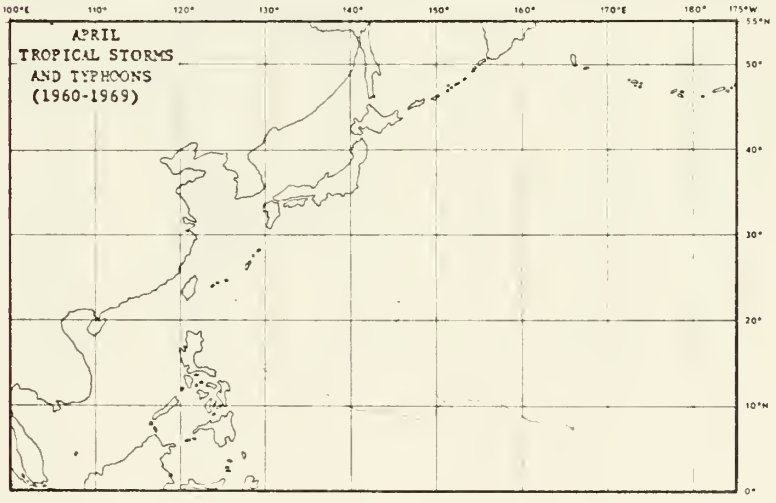
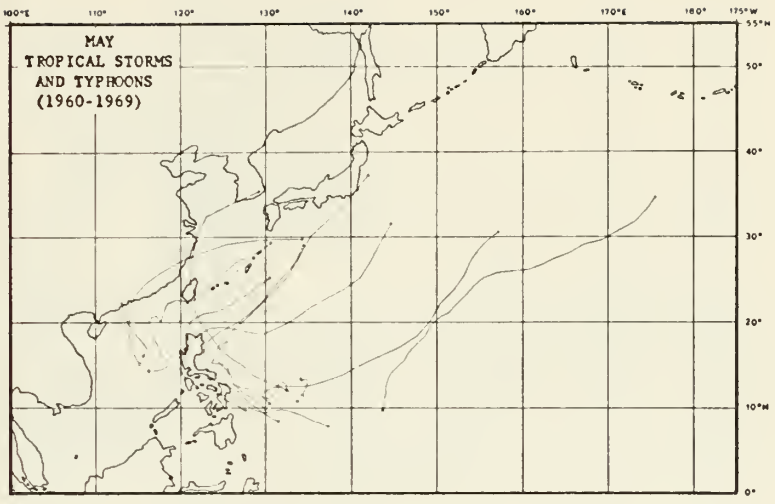


Figure 15. April tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)

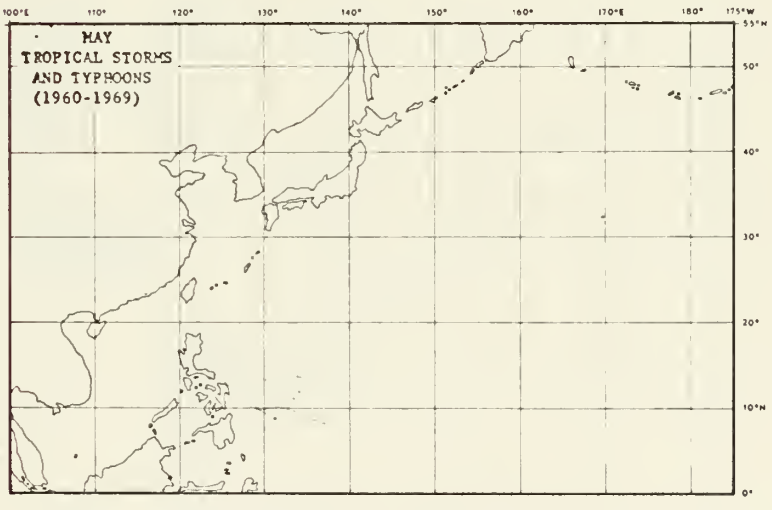
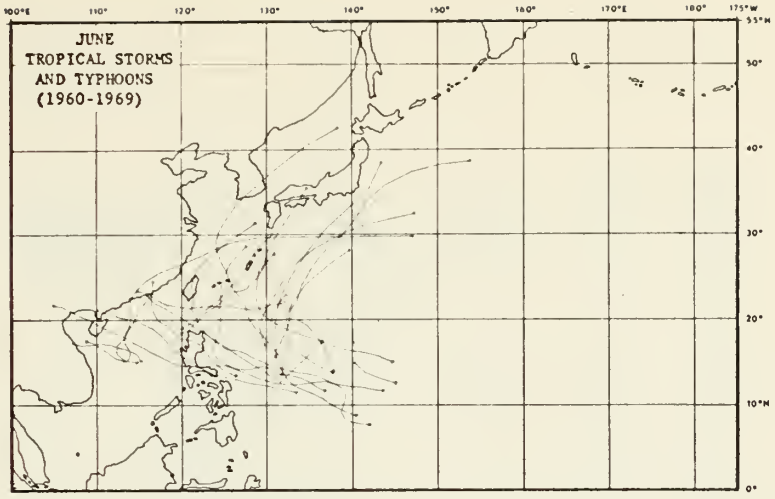
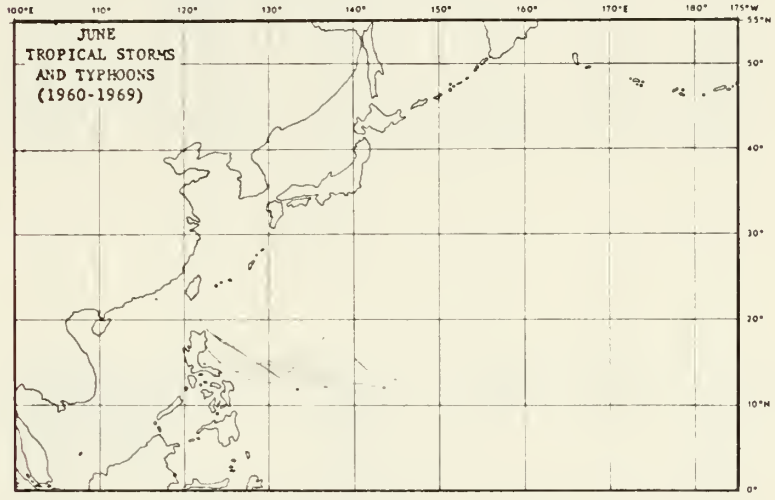


Figure 16. May tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) and the track segments of East-West storms (b) examined in this study.

(a)



(b)



(c)

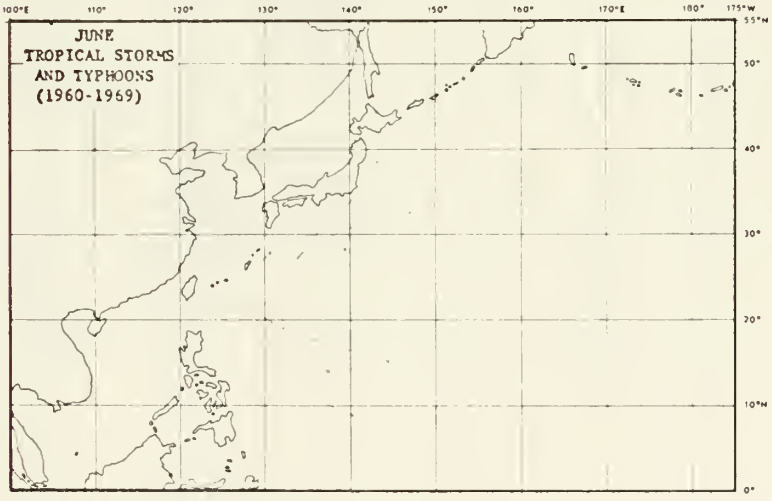
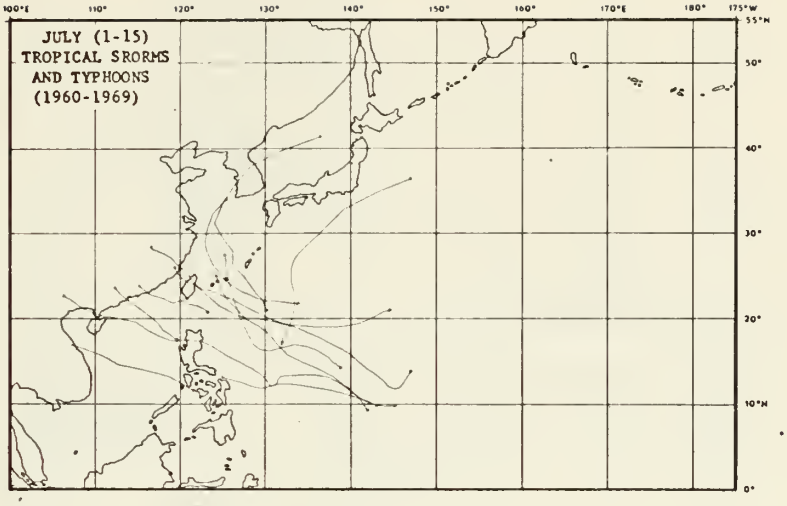


Figure 17. June tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)

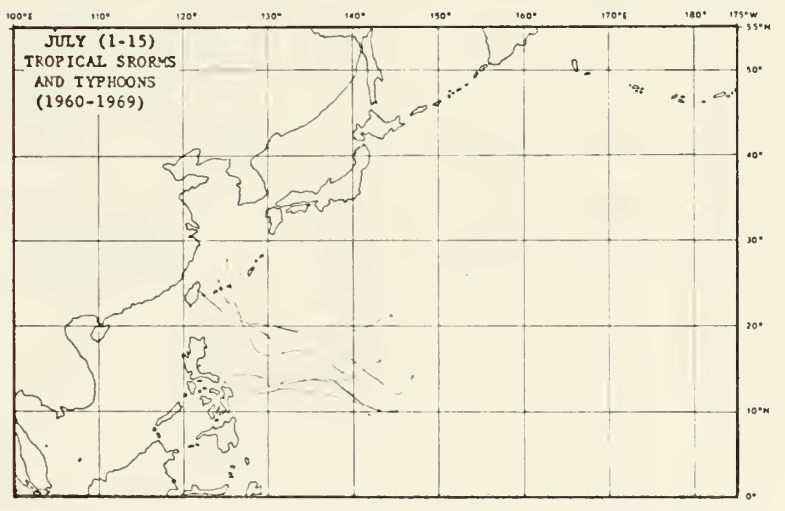
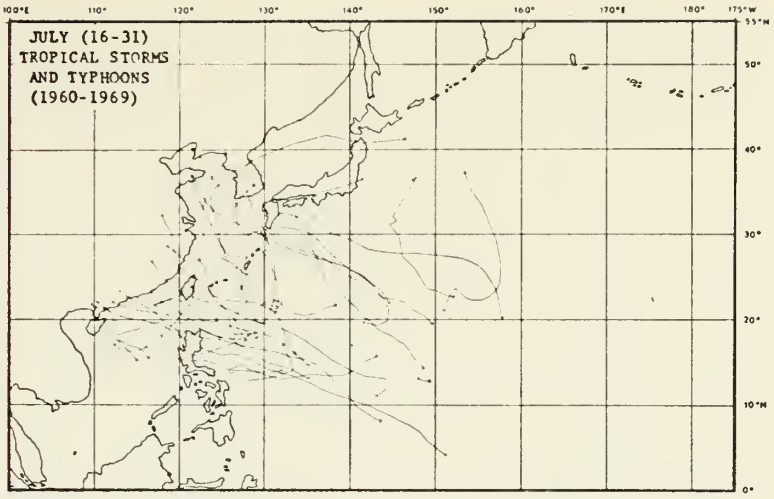
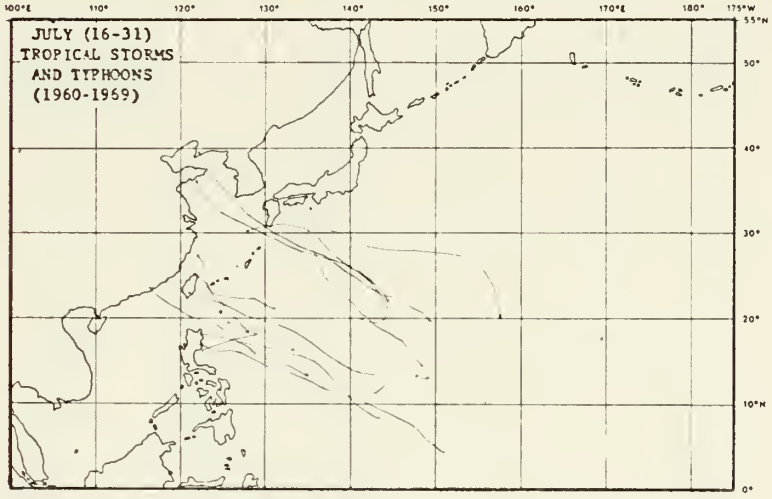


Figure 18. July (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) and the track segments of East-West storms (b) examined in this study.

(a)



(b)



(c)

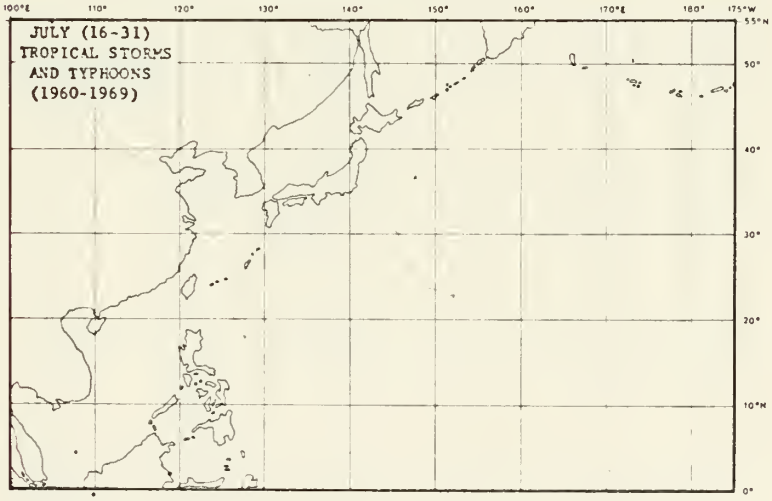
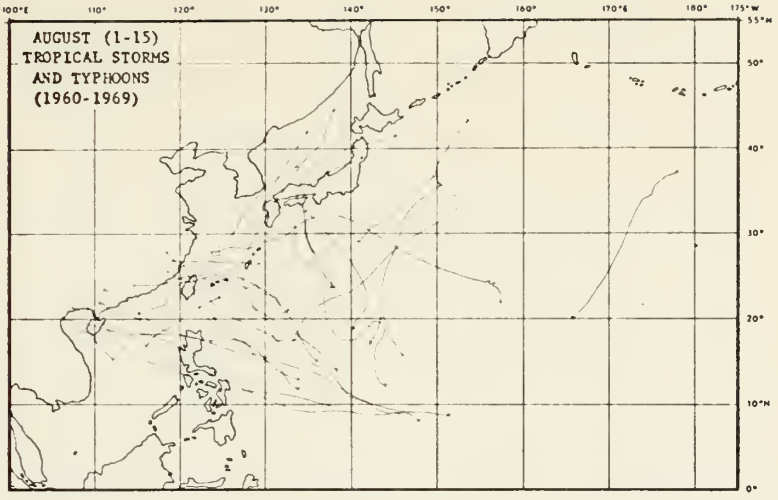
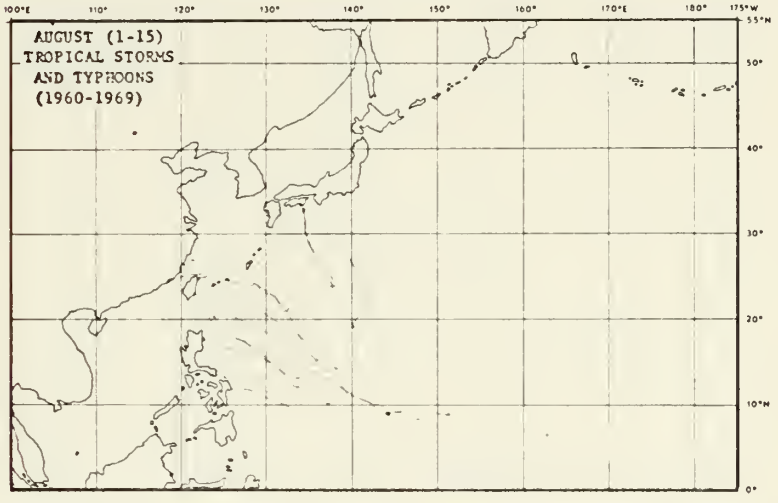


Figure 19. July (16-31) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

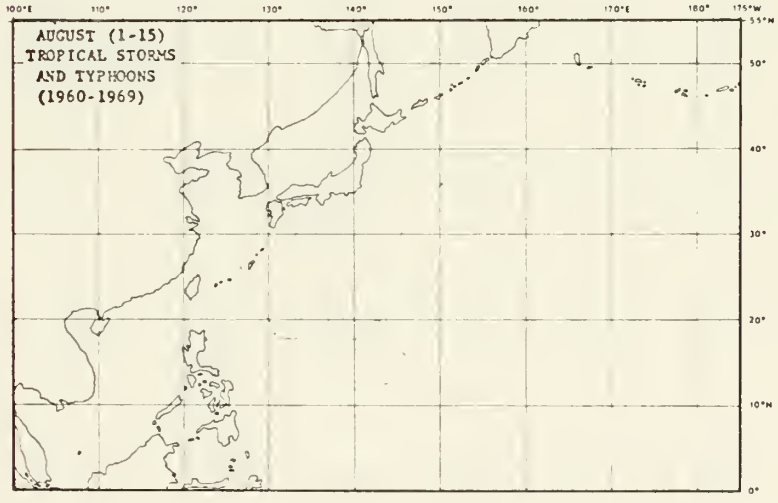


Figure 20. August (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

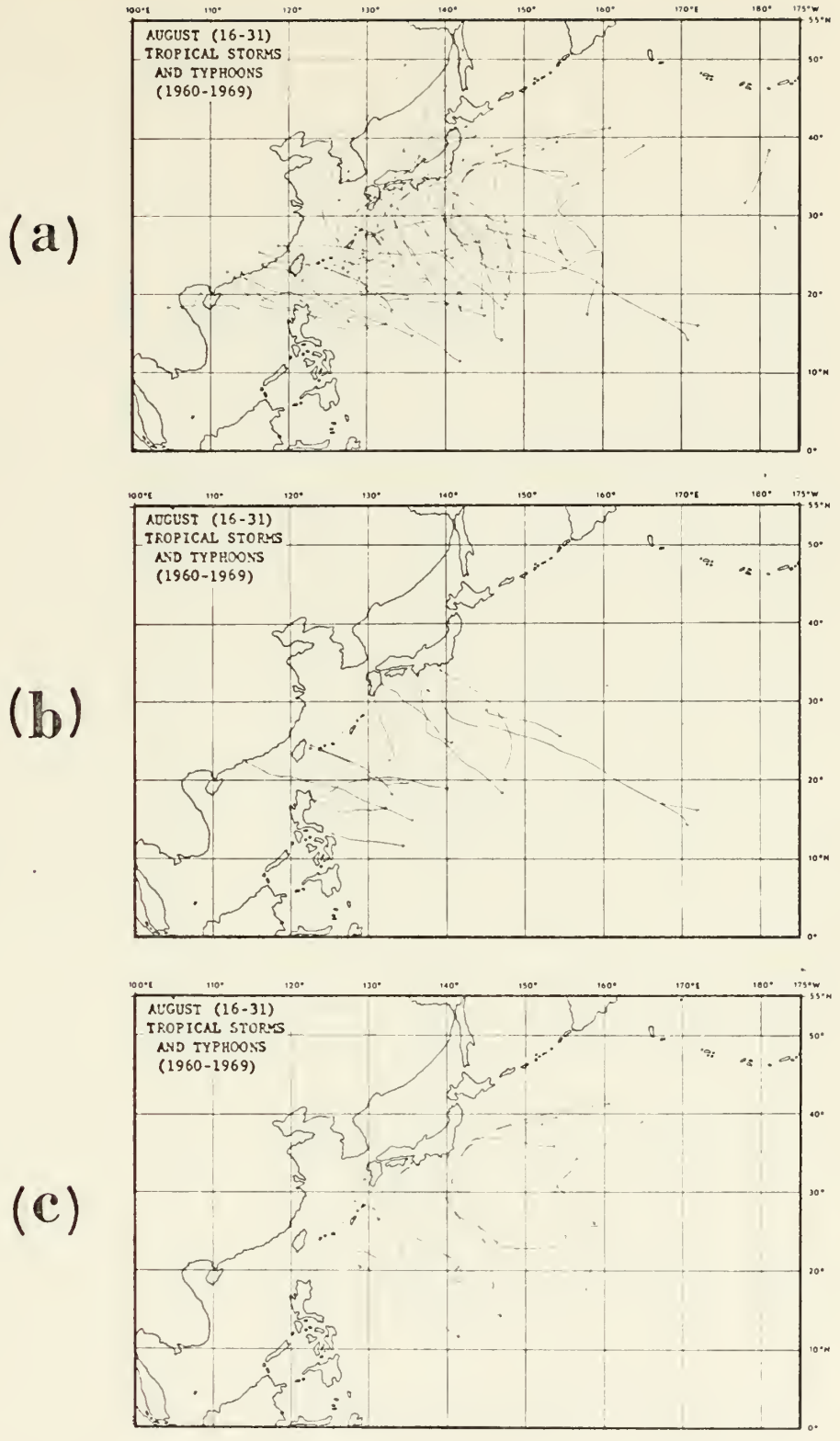


Figure 21. August (16-31) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

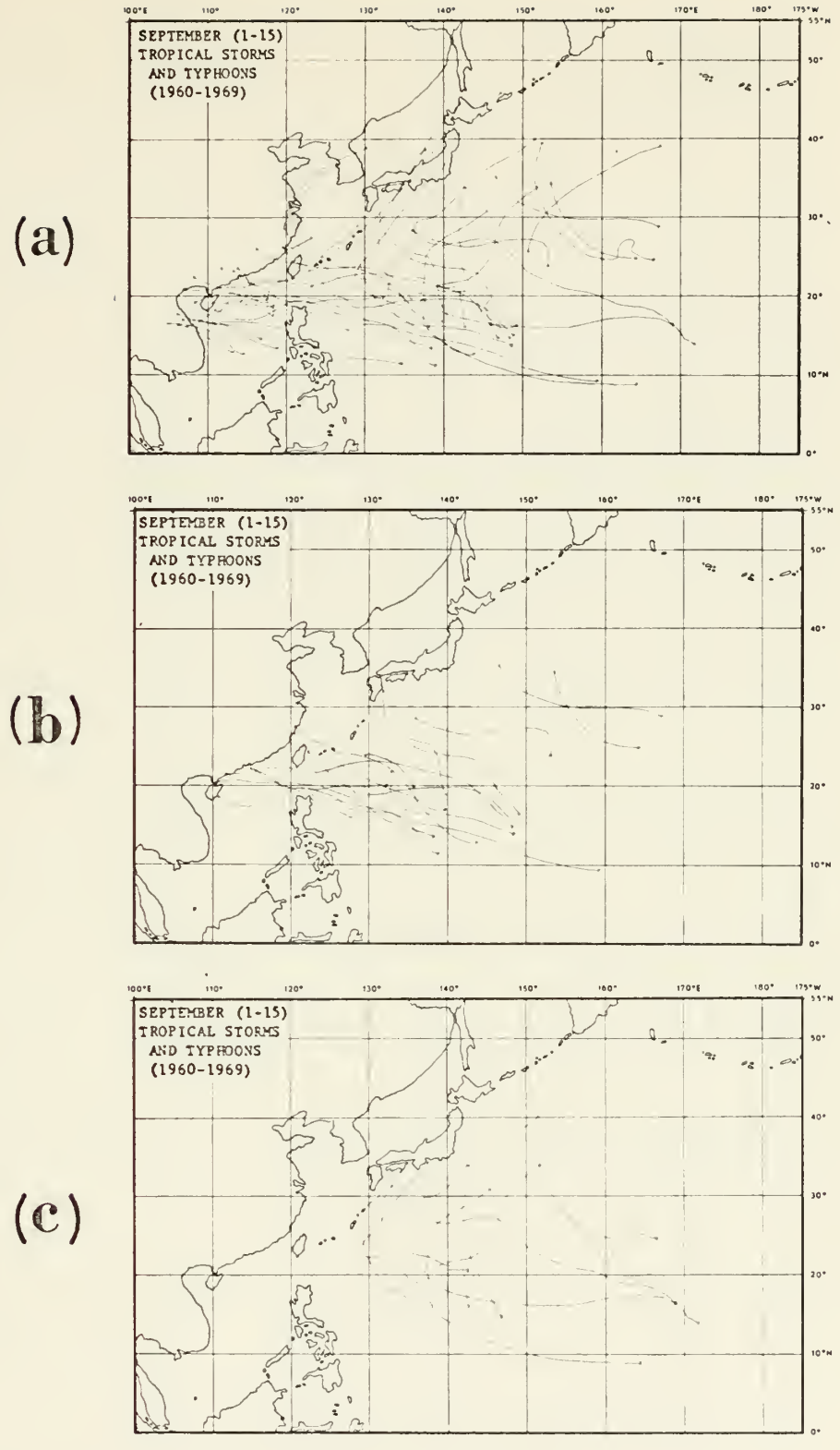
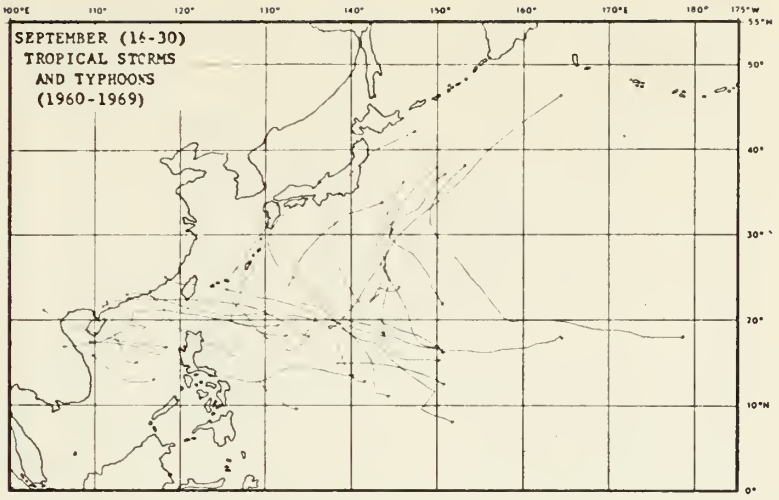
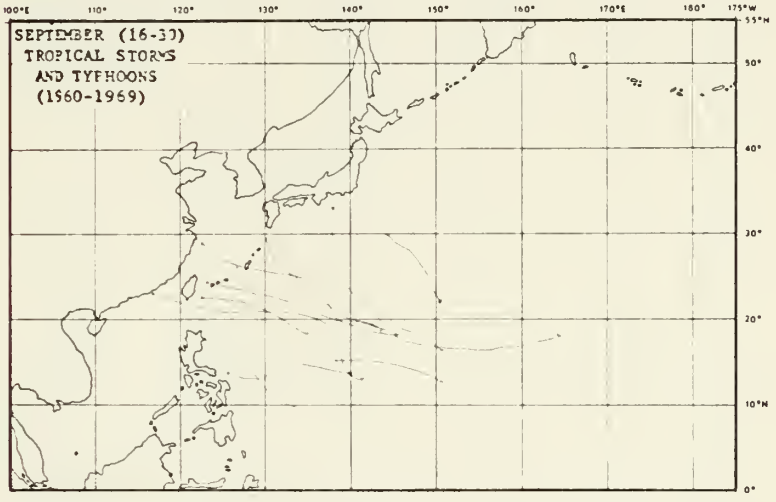


Figure 22. September (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

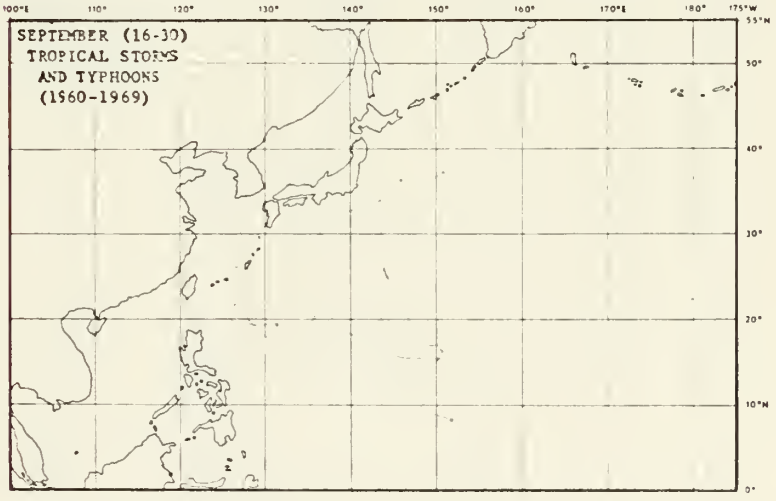
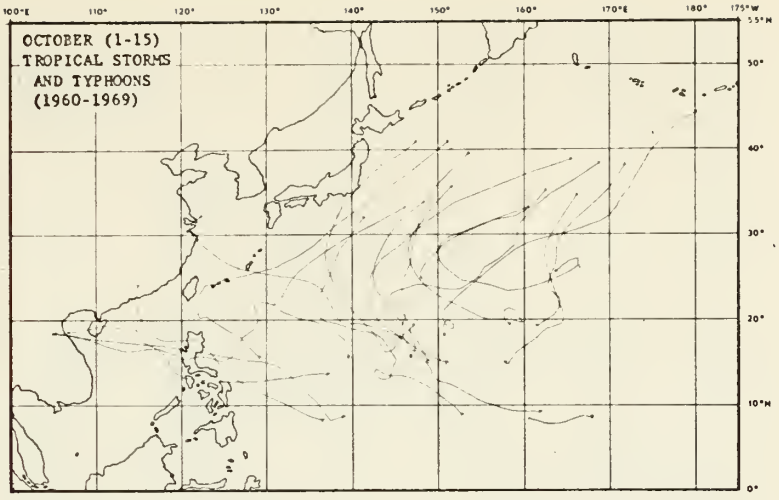
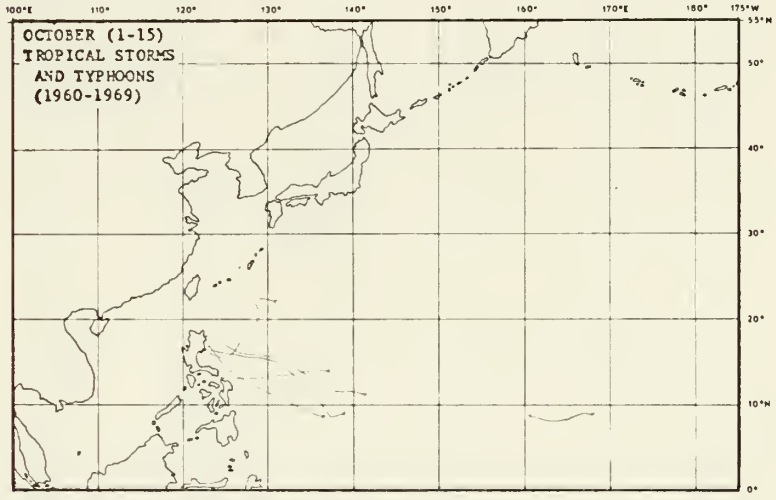


Figure 23. September (16-30) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

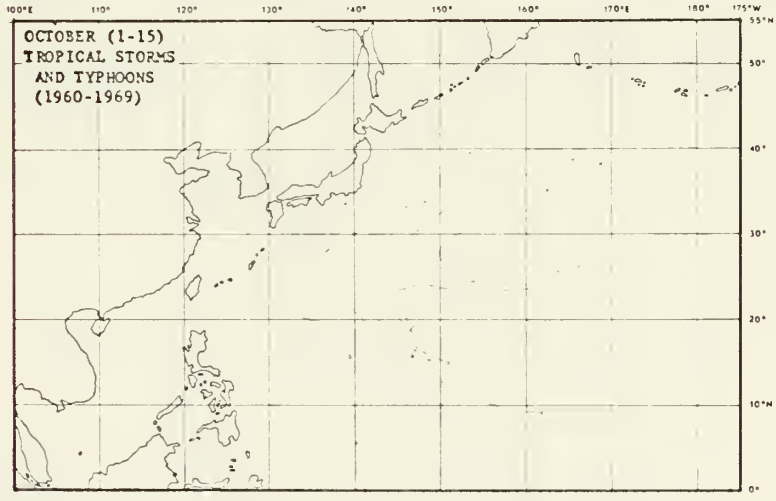
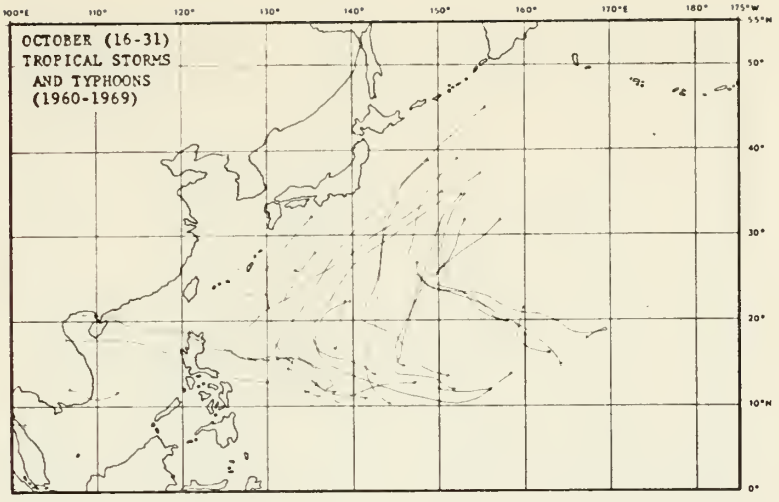
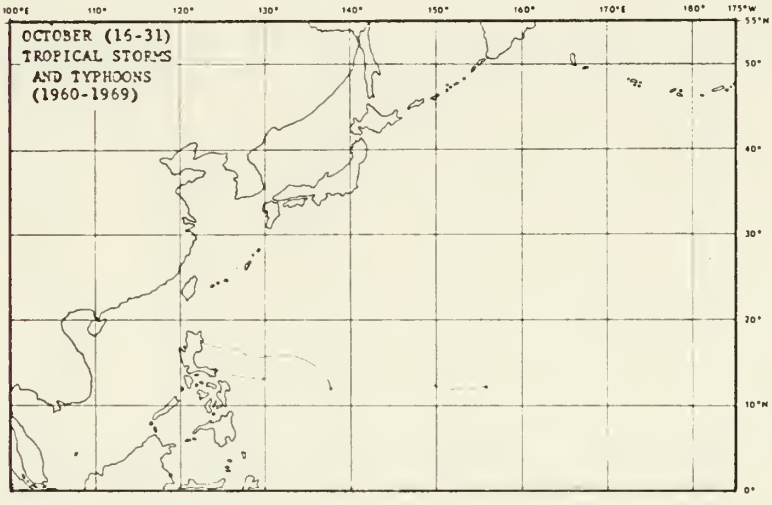


Figure 24. October (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

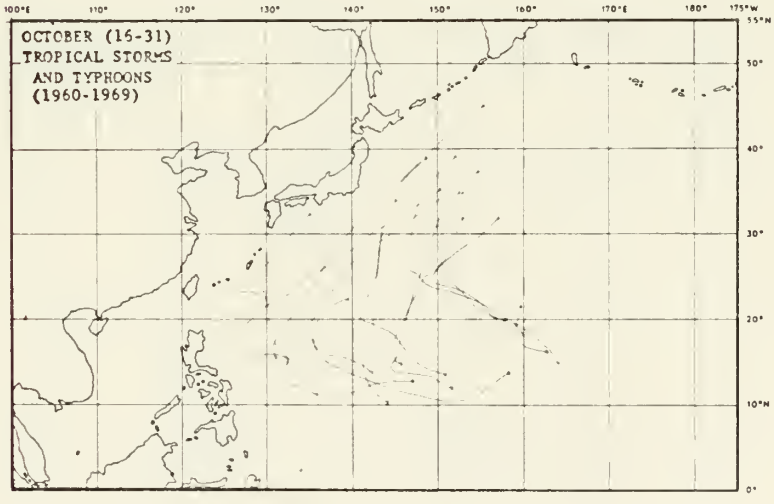
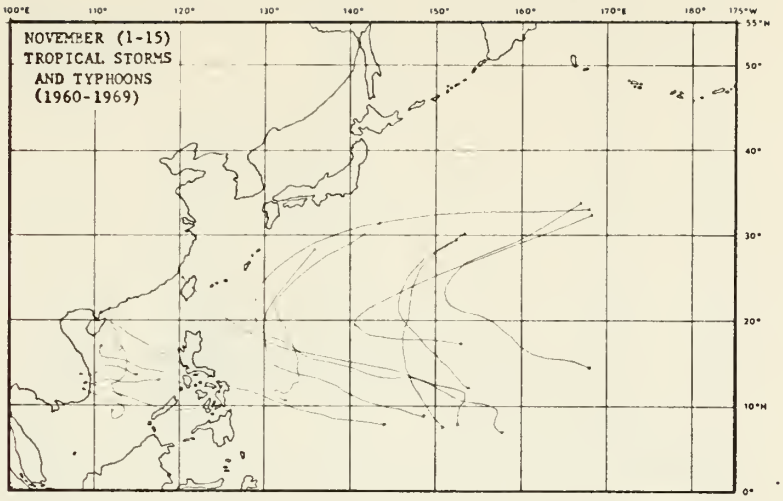
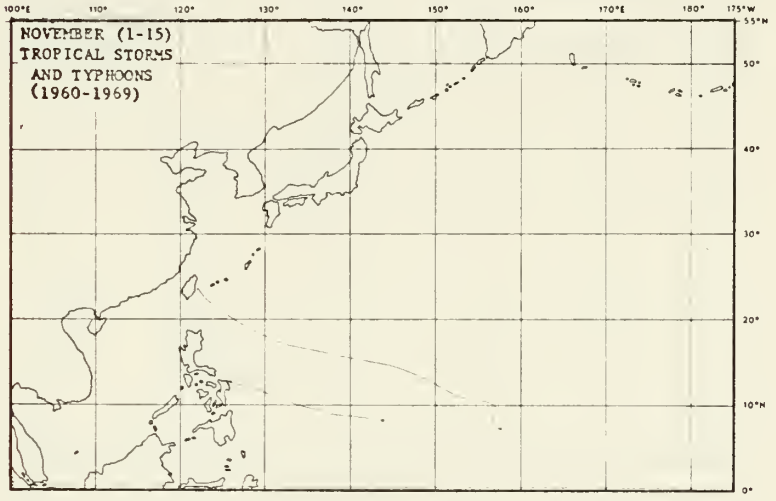


Figure 25. October (16-31) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

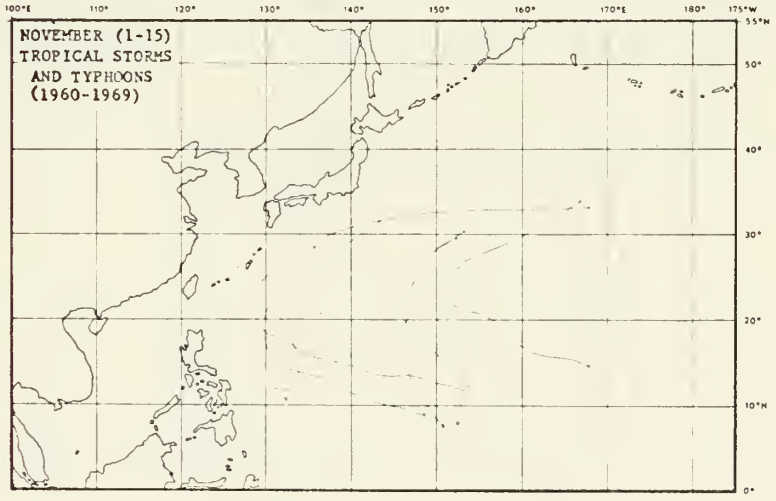
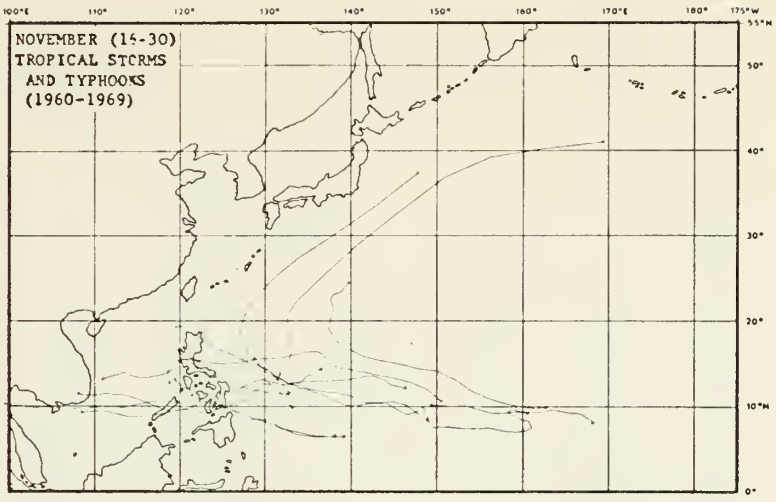
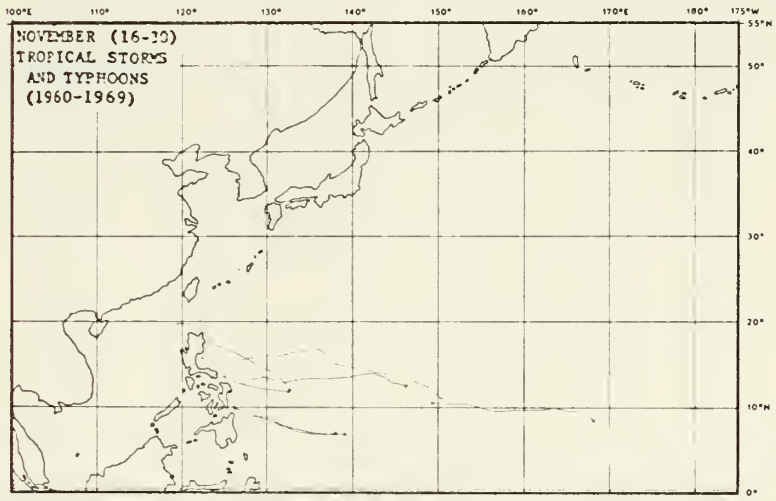


Figure 26. November (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

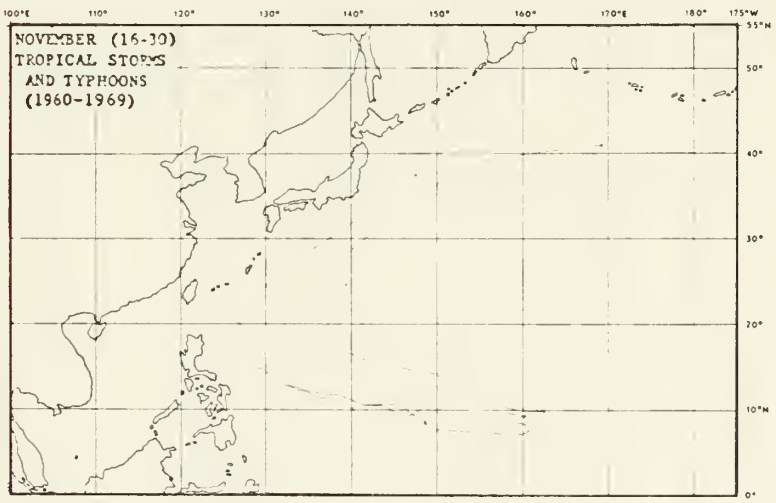
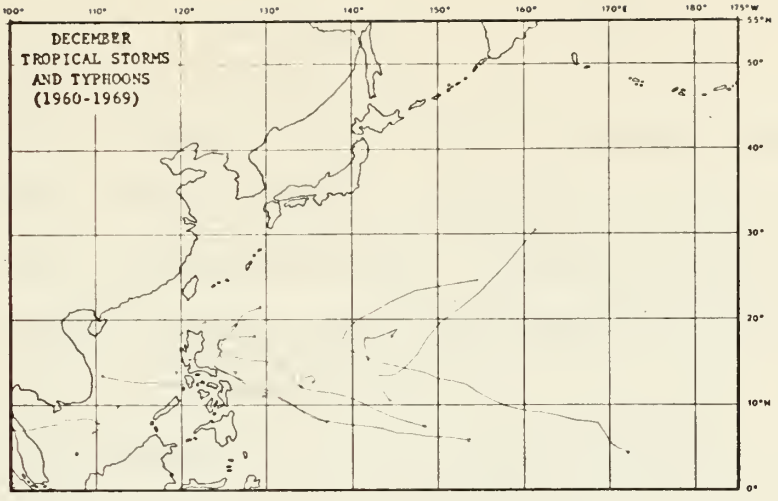
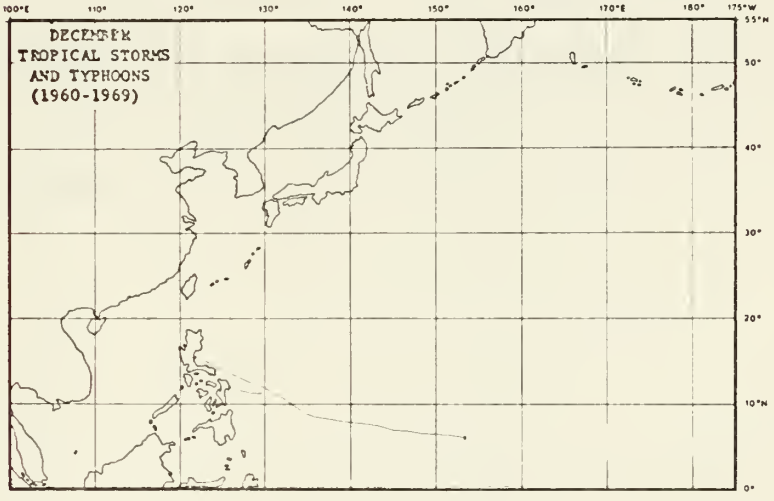


Figure 27. November (16-30) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)



(b)



(c)

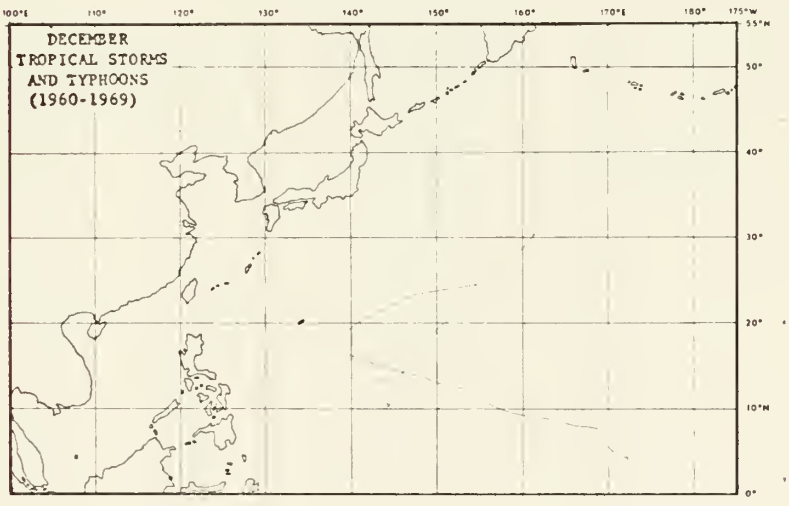


Figure 28. December tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

APPENDIX B

Statistical calculations of the 18 available parameters of the East-West moving tropical storms and typhoons during the period 1960-1969 are presented. Computations are shown for the two composited periods of the East-West storms: before and after maximum intensity.

Each table presents: (1) the number of tropical storms and typhoons for the period, (2) the number of six-hourly observations during the period, (3) the means and standard deviations of the 18 parameters, and (4) a correlation matrix of the 18 variables.

Number of East-West Tropical Storms and Typhoons: 114

Number of 6-Hourly Observations: 1277

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	16.60562	5.40795	12 C SLP	10	-6.75216	8.38279
LONG	2	134.97919	9.32066	MAX I	11	77.39211	33.04066
12 DIR	3	293.55347	28.85039	MIN 7 HT	12	286.39087	21.85344
12 SPD	4	11.14920	4.26670	7 R LT	13	28.76572	5.10727
24 DIR	5	293.04932	29.32910	7 R HT	14	316.68042	2.50971
24 SPD	6	10.86313	4.09859	7 T LONG	15	119.09247	10.67886
SIZE	7	4.65845	1.78689	7 T HT	16	308.45491	4.26153
12 C SIZ	8	0.08261	1.03602	12 C I	17	11.24044	9.79933
SLP	9	973.06274	25.21660	24 C I	18	21.50554	16.11357

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.115	0.248	0.113	0.276	0.092	-0.164	-0.057	-0.204	-0.034	0.170	-0.189	0.631	-0.136	-0.145	0.311	0.025	0.018
2		1.000	0.110	0.062	0.118	-0.019	0.020	0.098	0.166	0.049	-0.195	0.151	0.151	0.444	0.448	-0.073	-0.071	-0.057
3			1.000	-0.046	0.856	-0.095	-0.064	-0.003	-0.109	-0.071	0.079	-0.095	0.277	0.021	0.036	-0.017	0.070	0.071
4				1.000	0.022	0.941	-0.065	-0.071	0.021	-0.041	0.106	0.050	0.055	0.264	-0.121	0.093	0.062	0.118
5					1.000	-0.036	-0.081	0.002	-0.085	-0.058	0.067	-0.072	0.287	0.053	0.044	0.020	0.070	0.070
6						1.000	-0.049	-0.045	-0.039	-0.073	0.158	-0.006	0.023	0.252	-0.167	0.089	0.064	0.126
7							1.000	0.382	-0.207	-0.074	0.152	-0.235	0.043	0.030	0.071	0.080	0.045	0.069
8								1.000	0.014	-0.003	-0.055	0.002	0.018	0.072	0.037	0.021	-0.043	-0.024
9									1.000	0.557	-0.861	0.978	-0.109	0.033	0.115	-0.066	-0.413	-0.491
10										1.000	-0.390	0.519	-0.035	-0.084	0.110	-0.080	-0.520	-0.487
11											1.000	-0.841	0.074	-0.000	-0.141	0.037	0.487	0.593
12												1.000	-0.105	0.029	0.093	-0.065	-0.393	-0.463
13													1.000	0.193	0.062	0.300	0.085	0.075
14														1.000	0.049	0.153	0.107	0.137
15															1.000	-0.053	-0.092	-0.110
16																1.000	0.066	0.076
17																	1.000	0.846
18																		1.000

TABLE X. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons for all months (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 114

Number of 6-Hourly Observations: 698

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	20.60457	6.85451	12 C SLP	10	3.32319	8.18365
LONG	2	130.46576	9.82602	MAX I	11	74.53477	41.44125
12 DIR	3	297.24487	32.03293	MIN 7 HT	12	283.46069	24.66219
12 SPD	4	10.43478	4.27617	7 R LT	13	30.47391	6.00784
24 DIR	5	297.14038	28.71144	7 R HT	14	315.53760	2.43566
24 SPD	6	10.24928	3.94930	7 T LONG	15	116.03477	14.21540
SIZE	7	4.27536	2.05781	7 T HT	16	307.93311	15.99199
12 C SIZ	8	-0.14203	1.01228	12 C I	17	-6.33768	10.68967
SLP	9	971.03027	28.86295	24 C I	18	-5.81739	18.81728

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.014	0.293	0.204	0.331	0.224	-0.083	-0.075	-0.130	0.088	0.103	-0.100	0.844	-0.261	0.085	0.073	-0.093	-0.144
2		1.000	0.083	0.084	0.115	0.053	-0.102	0.097	0.219	-0.175	-0.199	0.125	0.070	0.369	0.522	-0.029	0.160	0.182
3			1.000	-0.071	0.825	-0.113	-0.162	-0.010	0.046	0.097	-0.015	0.045	0.098	-0.194	0.085	-0.005	-0.062	-0.046
4				1.000	-0.070	0.940	0.147	0.066	-0.095	0.031	0.125	-0.088	0.218	0.259	0.072	0.026	-0.012	0.083
5					1.000	-0.117	-0.140	0.019	0.039	0.076	-0.031	0.046	0.117	-0.211	0.115	-0.008	-0.056	-0.035
6						1.000	0.167	0.044	-0.118	0.056	0.151	-0.107	0.244	0.264	0.049	0.054	-0.050	0.033
7							1.000	0.283	-0.479	0.025	0.417	-0.498	0.103	0.015	0.005	0.045	0.102	0.054
8								1.000	-0.056	0.008	0.043	-0.057	-0.022	0.082	0.129	0.050	0.001	0.032
9									1.000	-0.044	-0.905	0.989	-0.163	0.085	0.071	0.003	-0.044	-0.134
10										1.000	0.111	-0.047	0.048	-0.191	-0.056	0.021	-0.455	-0.440
11											1.000	-0.895	0.113	-0.078	-0.055	-0.003	0.061	0.199
12												1.000	-0.145	0.076	0.061	0.005	-0.059	-0.152
13													1.000	-0.113	0.105	0.097	-0.054	-0.094
14														1.000	0.072	0.086	0.067	0.118
15															1.000	0.556	0.046	0.044
16																1.000	-0.026	-0.073
17																	1.000	0.768
18																		1.000

TABLE XI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons for all months (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 1

Number of 6-Hourly Observations: 7

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	15.44368	0.43055	12 C SLP	10	-2.12059	4.69159
LONG	2	129.89627	0.81187	MAX I	11	55.07861	7.15137
12 DIR	3	385.25049	8.39827	MIN 7 HT	12	302.04395	0.22495
12 SPD	4	5.82079	0.28442	7 R LT	13	25.55096	0.60266
24 DIR	5	387.92993	4.10666	7 R HT	14	313.15503	0.53969
24 SPD	6	4.58095	0.04087	7 T LONG	15	116.68687	5.51886
SIZE	7	4.48234	0.92494	7 T HT	16	304.27515	1.28618
12 C SIZ	8	-0.02065	1.03093	12 C I	17	12.15989	2.45832
SLP	9	992.12842	1.96367	24 C I	18	26.94537	2.09973

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.114	0.277	0.125	0.308	0.126	-0.143	-0.096	-0.166	0.184	0.113	-0.152	0.752	-0.253	-0.046	0.095	-0.230	-0.245
2		1.000	0.080	0.089	0.097	0.031	-0.018	0.119	0.196	-0.165	-0.182	0.192	0.102	0.439	0.496	-0.027	0.181	0.191
3			1.000	-0.063	0.840	-0.107	-0.120	-0.013	-0.031	0.039	0.025	-0.027	0.189	-0.093	0.055	-0.008	-0.037	-0.030
4				1.000	-0.026	0.941	0.048	0.000	-0.033	-0.050	0.118	-0.013	0.122	0.273	-0.008	0.038	0.074	0.130
5					1.000	-0.077	-0.115	0.002	-0.027	0.038	0.014	-0.019	0.210	-0.079	0.071	-0.003	-0.038	-0.029
6						1.000	0.063	0.003	-0.074	-0.053	0.155	-0.049	0.117	0.267	-0.044	0.055	0.057	0.109
7							1.000	0.340	-0.345	-0.073	0.300	-0.364	0.059	0.044	0.045	0.049	0.121	0.109
8								1.000	-0.016	-0.054	-0.001	-0.019	-0.018	0.099	0.097	0.039	0.054	0.070
9									1.000	0.206	-0.881	0.984	-0.142	0.065	0.094	-0.009	-0.145	-0.214
10										1.000	-0.145	0.176	0.084	-0.226	-0.044	-0.017	-0.654	-0.631
11											1.000	-0.865	0.089	-0.030	-0.085	0.005	0.220	0.318
12												1.000	-0.134	0.064	0.082	-0.008	-0.127	-0.196
13													1.000	0.006	0.014	0.119	-0.090	-0.106
14														1.000	0.086	0.091	0.211	0.236
15															1.000	0.405	0.067	0.058
16																1.000	0.014	-0.012
17																	1.000	0.882
18																		1.000

TABLE XII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during January (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 1

Number of 6-Hourly Observations: 11

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	15.88181	1.00081	12 C SLP	10	1.27273	2.83164
LONG	2	126.29079	2.49247	MAX I	11	46.36363	15.82575
12 DIR	3	273.72705	49.74551	MIN 7 HT	12	307.27271	2.53341
12 SPD	4	7.27273	1.84883	7 R LT	13	23.18181	1.25045
24 DIR	5	285.72705	54.11855	7 R HT	14	312.63623	1.12006
24 SPD	6	6.81818	1.99089	7 T LONG	15	105.36363	8.00340
SIZE	7	2.81818	0.87386	7 T HT	16	302.90894	1.13618
12 C SIZ	8	-0.45455	0.52223	12 C I	17	-6.81818	5.80908
SLP	9	996.54541	2.97871	24 C I	18	-9.09091	15.78261

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.954	0.623	-0.456	0.767	-0.780	0.853	-0.362	-0.570	0.309	0.952	-0.487	0.922	-0.890	0.027	0.148	0.398	0.622
2		1.000	0.822	-0.577	0.916	-0.794	0.940	-0.242	-0.739	0.265	0.988	-0.684	0.937	-0.965	0.272	0.261	0.588	0.811
3			1.000	-0.625	0.957	-0.569	0.871	0.037	-0.886	-0.004	0.796	-0.910	0.707	-0.851	0.578	0.355	0.794	0.955
4				1.000	-0.725	0.776	-0.709	-0.169	0.678	-0.188	-0.595	0.644	-0.370	0.536	-0.170	-0.892	-0.592	-0.798
5					1.000	-0.753	0.942	-0.037	-0.906	0.088	0.908	-0.879	0.780	-0.907	0.444	0.465	0.791	0.964
6						1.000	-0.826	0.105	0.524	-0.487	-0.785	0.427	-0.568	0.730	-0.033	-0.627	-0.359	-0.678
7							1.000	0.020	-0.765	0.265	0.924	-0.743	0.857	-0.892	0.296	0.385	0.611	0.883
8								1.000	-0.018	0.092	-0.220	-0.048	-0.167	0.373	0.378	0.092	0.166	0.116
9									1.000	0.277	-0.781	0.972	-0.566	0.725	-0.399	-0.486	-0.957	-0.926
10										1.000	0.192	0.309	0.408	-0.218	0.203	0.102	-0.335	0.039
11											1.000	-0.709	0.921	-0.928	0.225	0.286	0.652	0.815
12												1.000	-0.522	0.708	-0.454	-0.442	-0.925	-0.920
13													1.000	-0.876	0.322	0.013	0.454	0.675
14														1.000	-0.318	-0.264	-0.554	-0.800
15															1.000	0.037	0.509	0.504
16																1.000	0.429	0.563
17																	1.000	0.854
18																		1.000

TABLE XIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during January (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 22

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	7.49999	3.46237	12 C SLP	10	-2.00000	1.26491
LONG	2	129.81656	1.51452	MAX I	11	39.16666	4.91596
12 DIR	3	211.50000	112.36324	MIN 7 HT	12	300.83325	3.31159
12 SPD	4	4.00000	2.19089	7 R LT	13	13.66667	4.92612
24 DIR	5	227.00000	105.27296	7 R HT	14	316.33325	1.86190
24 SPD	6	2.83333	1.47196	7 T LONG	15	128.00000	2.60768
SIZE	7	3.00000	0.89443	7 T HT	16	300.16650	5.98052
12 C SIZ	8	-0.16667	0.98319	12 C I	17	2.50000	4.18330
SLP	9	993.83325	4.53505	24 C I	18	5.83333	5.84523

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.971	-0.423	0.749	-0.470	0.883	0.846	-0.311	0.972	-0.247	-0.670	0.986	0.989	-0.974	0.445	-0.942	0.442	-0.133
2		1.000	-0.299	0.856	-0.335	0.917	0.723	-0.441	0.892	-0.209	-0.508	0.930	0.939	-0.988	0.633	-0.972	0.592	-0.171
3			1.000	0.219	0.986	-0.049	-0.499	-0.017	-0.536	0.173	0.647	-0.404	-0.492	0.424	-0.005	0.363	0.169	0.285
4				1.000	0.198	0.868	0.408	-0.557	0.604	0.0	-0.186	0.717	0.667	-0.784	0.700	-0.824	0.655	-0.156
5					1.000	-0.130	-0.595	-0.122	-0.581	0.320	0.640	-0.450	-0.552	0.449	0.038	0.361	0.098	0.135
6						1.000	0.760	-0.161	0.774	-0.430	-0.299	0.855	0.873	-0.851	0.521	-0.814	0.731	0.136
7							1.000	0.227	0.888	-0.530	-0.682	0.878	0.908	-0.721	0.000	-0.636	0.267	0.191
8								1.000	-0.232	-0.643	0.172	-0.256	-0.179	0.473	-0.702	0.584	-0.211	0.725
9									1.000	-0.209	-0.815	0.983	0.973	-0.916	0.254	-0.876	0.237	-0.145
10										1.000	-0.161	-0.191	-0.353	0.170	0.061	0.0	-0.567	-0.812
11											1.000	-0.747	-0.674	0.583	0.156	0.584	0.365	0.377
12												1.000	0.977	-0.930	0.324	-0.907	0.325	-0.146
13													1.000	-0.945	0.374	-0.894	0.437	-0.058
14														1.000	-0.618	0.982	-0.514	0.245
15															1.000	-0.667	0.733	-0.394
16																1.000	-0.460	0.396
17																	1.000	0.307
18																		1.000

TABLE XIV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during February (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 26

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	8.71923	1.28125	12 C SLP	10	1.26923	1.97094
LONG	2	129.91144	1.20245	MAX I	11	33.84625	8.03836
12 DIR	3	295.65381	69.76926	MIN 7 HT	12	306.76904	6.12736
12 SPD	4	6.07692	1.76461	7 R LT	13	15.76923	5.99538
24 DIR	5	295.46143	76.10942	7 R HT	14	315.23071	2.43816
24 SPD	6	5.73077	1.51149	7 T LONG	15	107.07692	5.19170
SIZE	7	2.92308	0.68836	7 T HT	16	303.42285	3.48910
12 C SIZ	8	0.07692	0.93480	12 C I	17	-3.65385	5.75459
SLP	9	1000.19214	8.27535	24 C I	18	-2.88461	9.18401

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.059	-0.040	-0.599	-0.136	-0.495	0.047	-0.409	0.332	0.003	-0.493	0.332	-0.070	-0.319	0.037	0.097	-0.074	-0.230
2		1.000	-0.659	0.271	-0.644	0.213	0.465	-0.022	0.275	-0.351	0.152	0.174	0.707	-0.594	0.462	-0.590	0.414	0.494
3			1.000	-0.484	0.987	-0.590	-0.027	0.194	0.104	0.272	-0.201	0.219	-0.769	0.218	-0.467	0.398	-0.208	-0.287
4				1.000	-0.435	0.863	-0.094	0.215	-0.316	-0.167	0.387	-0.387	0.406	0.144	0.231	-0.350	0.186	0.372
5					1.000	-0.544	-0.065	0.186	0.030	0.235	-0.104	0.147	-0.780	0.276	-0.501	0.423	-0.177	-0.234
6						1.000	-0.136	0.213	-0.194	0.012	0.270	-0.283	0.465	0.072	0.405	-0.455	-0.003	0.316
7							1.000	0.507	0.628	-0.073	-0.342	0.612	0.364	-0.704	0.539	-0.569	-0.175	-0.037
8								1.000	0.101	0.097	0.066	0.080	-0.025	-0.026	0.073	-0.243	-0.169	0.190
9									1.000	0.330	-0.787	0.985	0.360	-0.902	0.721	-0.685	-0.371	-0.271
10										1.000	-0.497	0.356	0.087	-0.013	0.135	0.023	-0.527	-0.486
11											1.000	-0.826	-0.205	0.575	-0.549	0.296	0.683	0.725
12												1.000	0.281	-0.845	0.663	-0.583	-0.399	-0.378
13													1.000	-0.535	0.760	-0.628	-0.002	-0.020
14														1.000	-0.795	0.820	0.162	0.022
15															1.000	-0.856	-0.338	-0.184
16																1.000	0.120	-0.223
17																	1.000	0.682
18																		1.000

TABLE XV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during February (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 13

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	8.08235	1.51667	12 C SLP	10	2.11765	4.34284
LONG	2	150.32933	17.59666	MAX I	11	43.82352	15.66539
12 DIR	3	283.23511	8.12041	MIN 7 HT	12	305.52930	6.81099
12 SPD	4	11.41176	2.57533	7 R LT	13	21.94116	1.71284
24 DIR	5	285.76465	5.92167	7 R HT	14	318.47046	2.26709
24 SPD	6	10.94118	2.48673	7 T LONG	15	136.52940	19.69171
SIZE	7	3.64706	1.53871	7 T HT	16	302.17627	2.81148
12 C SIZ	8	0.05882	1.08804	12 C I	17	-2.35294	7.52447
SLP	9	996.29395	8.22925	24 C I	18	2.94118	16.01355

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.964	-0.099	0.336	-0.060	0.441	-0.801	-0.264	-0.225	0.268	0.479	-0.394	0.534	-0.954	-0.843	-0.221	-0.669	-0.048
2		1.000	0.082	-0.500	-0.032	-0.583	0.658	0.111	0.449	-0.129	-0.683	0.592	-0.670	0.946	0.867	0.082	0.561	-0.037
3			1.000	-0.059	0.877	-0.299	0.272	0.218	-0.332	-0.098	0.130	-0.421	-0.129	-0.020	0.015	0.551	0.076	0.840
4				1.000	0.150	0.902	-0.182	0.258	-0.569	0.163	0.849	-0.658	0.771	-0.217	0.576	-0.183	-0.028	0.333
5					1.000	-0.031	0.374	0.371	-0.535	-0.055	0.381	-0.657	0.208	-0.089	-0.102	0.671	0.008	0.828
6						1.000	-0.316	0.048	-0.534	0.273	0.808	-0.592	0.880	-0.316	-0.668	-0.177	-0.275	0.020
7							1.000	0.573	-0.228	-0.583	-0.083	-0.082	-0.246	0.624	0.660	0.622	0.653	0.298
8								1.000	-0.288	-0.293	0.298	-0.342	0.103	0.140	0.337	0.344	0.438	0.563
9									1.000	0.447	-0.882	0.936	-0.588	0.337	0.449	-0.648	-0.114	-0.391
10										1.000	-0.131	0.207	0.295	-0.082	-0.319	-0.560	-0.680	-0.005
11											1.000	-0.931	0.813	-0.494	-0.664	0.268	-0.078	0.376
12												1.000	-0.710	0.493	0.577	-0.540	0.093	-0.560
13													1.000	-0.491	-0.762	0.041	-0.496	0.155
14														1.000	0.757	-0.033	0.619	-0.032
15															1.000	0.126	0.646	-0.052
16																1.000	0.198	0.356
17																	1.000	0.100
18																		1.000

TABLE XVI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during March (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 13

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	8.56922	1.40557	12 C SLP	10	3.69231	3.70550
LONG	2	145.69223	17.71602	MAX I	11	45.00000	17.91182
12 DIR	3	282.07690	9.04121	MIN 7 HT	12	305.69214	7.85689
12 SPD	4	11.84615	2.82389	7 R LT	13	22.23076	1.87767
24 DIR	5	284.76904	6.49555	7 R HT	14	318.00000	2.41523
24 SPD	6	11.53846	2.56954	7 T LONG	15	129.61537	17.23145
SIZE	7	2.92308	0.86232	7 T HT	16	301.30762	2.65784
12 C SIZ	8	-0.23077	1.09193	12 C I	17	-4.61538	7.20576
SLP	9	997.00000	9.38083	24 C I	18	0.76923	17.89392

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.960	0.076	0.196	0.165	0.243	-0.717	0.044	-0.404	-0.226	0.498	-0.525	0.454	-0.977	-0.745	0.186	-0.505	0.132
2		1.000	-0.056	-0.419	-0.223	-0.468	0.544	-0.174	0.613	0.312	-0.711	0.705	-0.624	0.941	0.828	-0.279	0.397	-0.190
3			1.000	0.027	0.867	-0.210	0.086	0.103	-0.305	0.113	0.175	-0.424	-0.050	-0.137	-0.216	0.505	-0.090	0.829
4				1.000	0.275	0.897	0.200	0.501	-0.661	-0.069	0.857	-0.708	0.746	-0.110	-0.517	-0.004	0.187	0.448
5					1.000	0.128	0.220	0.262	-0.517	0.222	0.451	-0.678	0.340	-0.239	-0.425	0.632	-0.212	0.815
6						1.000	0.171	0.345	-0.685	-0.042	0.842	-0.685	0.870	-0.175	-0.556	0.108	-0.035	0.153
7							1.000	0.334	-0.185	0.018	0.081	-0.090	0.063	0.640	0.245	0.302	0.407	0.166
8								1.000	-0.244	0.063	0.426	-0.368	0.313	-0.063	0.021	0.084	0.224	0.522
9									1.000	0.465	-0.925	0.942	-0.681	0.438	0.740	-0.689	-0.031	-0.367
10										1.000	-0.308	0.240	0.119	0.261	0.215	-0.286	-0.495	0.230
11											1.000	-0.947	0.818	-0.482	-0.764	0.429	-0.000	-0.429
12												1.000	-0.763	0.553	0.800	-0.630	0.142	-0.567
13													1.000	-0.423	-0.775	0.285	-0.407	0.255
14														1.000	0.723	-0.338	0.527	-0.145
15															1.000	-0.401	0.448	-0.295
16																1.000	-0.181	0.266
17																	1.000	-0.051
18																		1.000

TABLE XVII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during March (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 46

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	9.25586	2.33435	12 C SLP	10	-6.85294	9.25769
LONG	2	136.58501	5.46002	MAX I	11	66.32352	22.74057
12 DIR	3	287.47046	11.65470	MIN 7 HT	12	288.55859	18.87466
12 SPD	4	9.70588	3.52934	7 R LT	13	23.64705	1.49509
24 DIR	5	286.58813	10.39556	7 R HT	14	316.23511	1.84323
24 SPD	6	10.00000	3.10425	7 T LONG	15	117.26 69	9.45261
SIZE	7	4.02941	0.83431	7 T HT	16	301.94116	3.03456
12 C SIZ	8	0.05882	0.77620	12 C I	17	8.82353	8.07716
SLP	9	975.64697	21.62891	24 C I	18	16.17647	10.66421

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.321	0.516	-0.177	0.617	-0.034	0.338	0.137	-0.407	-0.262	0.619	-0.442	-0.187	-0.695	-0.003	-0.211	-0.006	-0.087
2		1.000	-0.084	0.726	-0.071	0.696	0.138	0.070	0.841	0.441	-0.634	0.845	-0.333	0.732	0.111	-0.345	-0.377	-0.483
3			1.000	0.131	0.871	0.186	0.170	-0.161	-0.189	0.054	0.402	-0.231	0.328	-0-070	-0.130	-0.421	-01277	-0.268
4				1.000	0.201	0.951	0.003	-0.159	0.689	0.522	-0.395	0.653	0.100	0.756	0.323	-0.319	-0.220	-0.321
5					1.000	0.263	0.386	0.007	-0.162	0.000	0.412	-0.204	0.261	-0.145	-0.222	-0.450	-0.190	-0.251
6						1.000	0.000	-0.126	0.644	0.485	-0.328	0.608	0.026	0.667	0.378	-0.344	-0.284	-0.398
7							1.000	0.559	0.007	-0.338	0.054	0.016	-0.040	-0.162	-0.216	-0.358	0.005	-0.072
8								1.000	0.003	-0.183	-0.013	0.035	-0.295	-0.137	-0.031	-0.320	-0.085	-0.100
9									1.000	0.628	-0.856	0.993	-0.390	0.664	0.071	-0.358	-0.359	-0.611
10										1.000	-0.356	0.616	-0.265	0.488	-0.024	-0.283	-0.259	-0.451
11											1.000	-0.859	0.322	-0.564	-0.004	0.078	0.429	0.546
12												1.000	-0.407	0.670	0.049	-0.355	-0.345	-0.591
13													1.000	0.240	0.101	0.211	0.291	0.492
14														1.000	0.228	-0.214	-0.205	-0.184
15															1.000	-0.005	0.149	0.128
16																1.000	0.121	0.381
17																	1.000	0.782
18																		1.000

TABLE XVIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during April (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 23

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	11.95650	3.01629	12 C SLP	10	6.95652	5.08543
LONG	2	127.69994	3.76702	MAX I	11	81.73912	33.93202
12 DIR	3	305.43457	26.67961	MIN 7 HT	12	274.95630	19.43394
12 SPD	4	7.00000	5.93142	7 R LT	13	314.47803	0.99405
24 DIR	5	299.73901	20.21524	7 R HT	14	101.86955	44.33580
24 SPD	6	6.43478	4.83195	7 T LONG	15	286.86938	84.17355
SIZE	7	3.60870	0.89133	7 T HT	16	-8.91304	13.64788
12 C SIZ	8	-0.21739	0.67126	12 C I	17	-9.78261	21.92331
SLP	9	961.95630	23.46072	24 C I	18	-9.78261	21.92331

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.272	-0.337	0.397	-0.257	0.441	0.785	-0.151	-0.508	-0.005	0.633	-0.506	0.662	0.145	-0.215	-0.199	0.379	0.325
2		1.000	-0.353	0.656	-0.343	0.561	-0.164	-0.289	0.306	-0.604	-0.287	0.323	-0.491	0.540	-0.200	-0.121	-0.142	0.275
3			1.000	-0.677	0.796	-0.700	-0.335	0.224	0.484	0.475	-0.577	0.455	-0.306	-0.353	0.211	0.141	-0.282	-0.520
4				1.000	-0.563	0.979	0.206	-0.400	0.007	-0.449	0.163	0.043	-0.047	0.802	-0.195	-0.086	-0.003	0.400
5					1.000	-0.598	-0.235	0.237	0.409	0.383	-0.482	0.385	-0.005	-0.292	0.199	0.125	-0.185	-0.422
6						1.000	0.189	-0.446	-0.037	-0.362	0.210	0.003	-0.005	0.769	-0.157	-0.041	-0.073	0.349
7							1.000	0.231	-0.736	-0.275	0.767	-0.746	0.659	-0.138	-0.357	-0.368	0.653	0.540
8								1.000	-0.116	0.184	0.067	-0.123	-0.015	-0.246	0.298	0.256	0.275	-0.120
9									1.000	0.376	-0.971	0.998	-0.750	0.477	0.301	0.320	-0.718	-0.710
10										1.000	-0.353	0.361	-0.083	-0.113	0.405	0.386	-0.507	-0.815
11											1.000	-0.960	0.757	-0.295	-0.272	-0.271	0.722	0.720
12												1.000	-0.755	0.505	0.322	0.347	-0.717	-0.693
13													1.000	-0.399	-0.213	-0.256	0.550	0.468
14														1.000	0.018	0.106	-0.308	-0.109
15															1.000	0.989	-0.108	-0.427
16																1.000	-0.155	-0.409
17																	1.000	0.713
18																		1.000

TABLE XIX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during April (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 51

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	12.34781	3.24469	12 C SLP	10	-4.95652	7.07413
LONG	2	128.49553	2.96548	MAX I	11	80.00000	26.01047
12 DIR	3	293.65210	17.80092	MIN 7 HT	12	290.69556	14.72297
12 SPD	4	8.47826	2.95219	7 R LT	13	20.08694	2.62701
24 DIR	5	292.86938	15.66785	7 R HT	14	315.69556	0.76484
24 SPD	6	8.34783	2.53357	7 T LONG	15	115.47826	8.17351
SIZE	7	3.47826	0.59311	7 T HT	16	115.47826	8.17351
12 C SIZ	8	-0.08696	0.66831	12 C I	17	307.86938	2.41782
SLP	9	978.52173	16.51407	24 C I	18	16.73912	22.56548

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.820	0.790	0.755	0.801	0.795	-0.053	-0.394	-0.914	-0.345	0.868	-0.915	0.822	0.312	-0.249	-0.380	0.207	0.286
2		1.000	-0.666	-0.391	-0.533	-0.407	-0.012	0.209	0.875	0.483	-0.793	0.924	-0.894	-0.207	0.177	0.056	-0.307	-0.227
3			1.000	0.543	0.920	0.612	0.171	-0.136	-0.898	-0.461	0.919	-0.852	0.659	0.152	-0.187	-0.353	0.467	0.690
4				1.000	0.656	0.870	0.175	-0.554	-0.558	-0.188	0.504	-0.515	0.493	0.269	0.001	-0.564	0.035	0.113
5					1.000	0.677	0.115	-0.348	-0.812	-0.226	0.851	-0.758	0.570	0-201	-0.267	-0.382	0.288	0.545
6						1.000	-0.055	-0.465	-0.634	-0.287	0.633	-0.593	0.535	0.409	-0.017	-0.593	0.199	0.270
7							1.000	-0.005	0.038	-0.124	-0.053	0.080	0.118	-0.065	0.616	-0.303	0.258	0.146
8								1.000	0.214	-0.124	-0.233	0.224	-0.280	-0.232	-0.167	0.415	0.066	0.047
9									1.000	0.582	-0.970	0.987	-0.836	-0.314	0.309	0.272	-0.454	-0.541
10										1.000	-0.522	0.539	-0.509	-0.417	-0.042	0.293	-0.754	-0.597
11											1.000	-0.942	0.790	0.366	-0.321	-0.276	0.542	0.656
12												1.000	-0.844	-0.255	0.299	0.208	-0.377	-0.451
13													1.000	0.511	-0.051	-0.299	0.495	0.257
14														1.000	-0.034	-0.391	0.601	0.230
15															1.000	-0.500	0.135	-0.067
16																1.000	-0.332	-0.326
17																	1.000	0.775
18																		1.000

TABLE XX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during May (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 25

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	14.61428	4.41062	12 C SLP	10	1.71428	3.04905
LONG	2	127.50708	4.88554	MAX I	11	54.28571	46.41853
12 DIR	3	309.28564	40.96983	MIN 7 HT	12	297.00000	20.07294
12 SPD	4	7.07143	3.89209	7 R LT	13	24.92856	5.62226
24 DIR	5	311.78564	23.95244	7 R HT	14	316.12411	0.89258
24 SPD	6	7.07143	3.47440	7 T LONG	15	305.71411	9.25018
SIZE	7	2.78571	0.57893	7 T HT	16	-3.21428	3.83162
12 C SIZ	8	-0.42857	0.75593	12 C I	17	0.71429	7.74773
SLP	9	987.78564	23.59651	24 C I	18	0.71429	14.99450

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.653	0.376	0.250	0.460	0.402	0.176	0.207	-0.880	0.862	0.834	-0.889	0.963	0.579	-0.573	0.497	-0.608	-0.317
2		1.000	-0.436	-0.856	-0.393	-0.908	-0.095	-0.416	0.809	-0.404	-0.705	0.846	-0.547	-0.089	-0.080	-0.554	0.135	-0.065
3			1.000	0.278	-0.328	0.287	-0.497	-0.068	-0.351	0.200	0.280	-0.381	0.314	-0.149	0.064	0.290	-0.231	-0.333
4				1.000	0.357	0.967	0.007	0.456	-0.455	-0.031	0.325	-0.502	0.123	-0.293	0.482	0.228	0.184	0.201
5					1.000	0.395	0.684	0.611	-0.416	0.526	0.380	-0.434	0.421	0.423	-0.195	0.180	-0.322	-0.024
6						1.000	0.085	0.452	-0.577	0.104	0.449	-0.623	0.296	-0.154	0.344	0.256	0.081	0.154
7							1.000	0.653	-0.280	0.311	0.323	-0.271	0.255	0.691	-0.364	0.317	-0.080	0.241
8								1.000	-0.299	0.176	0.210	-0.345	0.264	0.375	0.080	0.247	-0.122	-0.039
9									1.000	-0.652	-0.980	0.996	-0.854	-0.545	0.510	-0.744	0.232	-0.118
10										1.000	0.644	-0.660	0.815	0.646	-0.598	0.486	-0.823	-0.470
11											1.000	-0.959	0.825	0.598	-0.627	0.799	-0.175	0.222
12												1.000	-0.857	-0.524	0.452	-0.718	0.265	-0.066
13													1.000	0.693	-0.674	0.481	-0.580	-0.280
14														1.000	-0.779	0.469	-0.393	-0.070
15															1.000	-0.463	0.301	-0.035
16																1.000	-0.083	0.304
17																	1.000	0.852
18																		1.000

TABLE XXI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during May (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 6

Number of 6-Hourly Observations: 60

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	15.09995	2.09938	12 C SLP	10	-6.42857	5.72176
LONG	2	128.23772	4.95140	MAX I	11	88.73808	29.98050
12 DIR	3	289.00000	13.07201	MIN 7 HT	12	285.92847	16.01733
12 SPD	4	10.61905	2.09474	7 R LT	13	23.95238	2.34731
24 DIR	5	288.09521	11.76146	7 R HT	14	314.57129	2.07356
24 SPD	6	10.83333	2.32606	7 T LONG	15	117.88095	9.32659
SIZE	7	3.83333	0.79377	7 T HT	16	305.38086	3.25315
12 C SIZ	8	0.04762	0.85404	12 C I	17	12.61905	10.21703
SLP	9	972.16650	17.09642	24 C I	18	24.69048	16.14334

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.769	0.634	0.255	0.644	0.288	0.284	-0.067	-0.260	0.200	0.106	-0.311	0.441	-0.392	-0.450	-0.019	-0.348	-0.490
2		1.000	-0.378	-0.472	-0.366	-0.387	-0.240	0.160	0.420	-0.156	-0.150	0.432	-0.818	0.179	0.658	-0.150	0.054	0.176
3			1.000	0.200	0.659	0.304	0.066	-0.044	-0.018	0.178	-0.075	-0.084	0.103	0.130	-0.108	-0.022	-0.194	-0.237
4				1.000	0.008	0.753	0.225	-0.017	-0.199	-0.213	0.040	-0.192	0.458	0.231	-0.351	0.161	0.008	-0.002
5					1.000	-0.145	0.080	-0.015	-0.089	0.072	-0.046	-0.139	0.159	-0.098	-0.113	-0.069	-0.179	-0.291
6						1.000	0.183	-0.033	-0.013	-0.093	-0.127	-0.021	0.347	0.344	-0.246	0.063	-0.045	-0.034
7							1.000	0.552	0.444	0.172	-0.459	0.425	0.271	-0.252	-0.253	0.242	-0.477	-0.430
8								1.000	0.255	0.189	-0.201	0.268	-0.072	0.012	0.276	-0.059	-0.241	-0.094
9									1.000	0.270	-0.890	0.992	-0.128	0.219	0.078	0.338	-0.301	-0.159
10										1.000	-0.092	0.274	0.225	-0.098	-0.176	0.033	-0.234	0.020
11											1.000	-0.880	-0.131	-0.292	0.035	-0.359	0.231	0.203
12												1.000	-0.101	0.254	0.092	0.339	-0.255	-0.105
13													1.000	0.131	-0.683	0.402	0.108	0.131
14														1.000	0.065	0.220	0.503	0.625
15															1.000	-0-591	0.050	0.124
16																1.000	0.159	0.058
17																	1.000	0.832
18																		1.000

TABLE XXII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during June (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 6

Number of 6-Hourly Observations: 7

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	18.57690	3.26806	12 C SLP	10	6.62538	8.22130
LONG	2	124.03838	7.72434	MAX I	11	93.23076	41.98044
12 DIR	3	312.76904	18.42169	MIN 7 HT	12	284.76904	19.17094
12 SPD	4	10.46154	1.71344	7 R LT	13	26.07692	1.49786
24 DIR	5	308.00000	15.55099	7 R HT	14	312.92285	2.81252
24 SPD	6	9.84615	1.40512	7 T LONG	15	116.07692	11.43431
SIZE	7	2.53846	0.87706	7 T HT	16	306.69214	2.49615
12 C SIZ	8	-0.61538	0.76795	12 C I	17	-9.84615	11.73915
SLP	9	970.61523	19.58116	24 C I	18	1.69231	21.08862

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.723	0.530	0.039	0.620	0.384	-0.158	-0.239	-0.299	0.468	0.374	-0.360	0.334	-0.942	-0.692	-0.036	-0.100	-0.575
2		1.000	-0.286	0.445	-0.376	-0.052	-0.431	0.187	0.484	-0.138	-0.460	0.562	-0.498	0.563	0.921	-0.394	-0.313	0.052
3			1.000	-0.039	0.980	-0.008	-0.131	0.136	-0.255	0.662	0.431	-0.372	-0.365	-0.576	0.245	0.446	-0.271	-0.613
4				1.000	-0.069	0.793	-0.845	-0.019	0.125	0.552	-0.020	0.171	-0.177	-0.061	0.381	-0.432	-0.762	-0.538
5					1.000	-0.004	-0.104	0.084	-0.183	0.660	0.365	-0.303	-0.200	-0.636	-0.365	0.425	-0.256	-0.651
6						1.000	-0.671	0.059	-0.196	0.665	0.302	-0.150	0.125	-0.320	-0.082	-0.276	-0.595	-0.477
7							1.000	0.162	-0.060	-0.547	-0.058	-0.106	0.283	0.255	-0.428	0.539	0.736	0.541
8								1.000	-0.100	0.289	0.196	-0.050	-0.318	0.169	0.139	0.328	-0.035	-0.008
9									1.000	-0.225	-0.958	0.981	0.353	0.328	0.231	-0.194	-0.264	-0.240
10										1.000	0.461	-0.264	-0.180	-0.427	-0.177	0.229	-0.654	-0.735
11											1.000	-0.945	-0.386	-0.381	-0.263	0.256	0.137	0.060
12												1.000	0.337	0.378	0.306	-0.315	-0.213	-0.154
13													1.000	-0.117	-0.623	-0.082	0.151	-0.012
14														1.000	0.467	0.151	0.157	0.574
15															1.000	-0.440	-0.268	0.144
16																1.000	0.042	0.001
17																	1.000	0.744
18																		1.000

TABLE XXIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during June (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 21

Number of 6-Hourly Observations: 251

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	17.26657	4.13427	12 C SLP	10	-6.62144	9.06753
LONG	2	135.70229	7.64074	MAX I	11	78.65248	27.75966
12 DIR	3	297.65942	27.61720	MIN 7 HT	12	288.11328	21.57544
12 SPD	4	11.57447	4.17514	7 R LT	13	28.64539	3.60976
24 DIR	5	295.27637	37.79814	7 R HT	14	316.63818	2.70785
24 SPD	6	11.11347	4.01797	7 T LONG	15	I15.45389	10.22421
SIZE	7	4.65248	1.86694	7 T HT	16	307.07788	-3.51947
12 C SIZ	8	0.02128	1.13684	12 C I	17	12.31206	11.55423
SLP	9	974.59570	24.72037	24 C I	18	23.47517	17.21812

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.222	0.190	-0.112	0.266	-0.048	-0.234	-0.141	-0.241	-0.225	0.067	-0.283	0.766	-0.174	0.170	0.102	0.083	0.050
2		1.000	0.321	-0.239	0.237	-0.376	-0.010	0.186	0.079	0.060	-0.242	0.053	0.440	0.315	0.320	0.067	-0.096	-0.076
3			1.000	-0.199	0.602	-0.319	0.220	0.251	-0.092	-0.142	-0.118	-0.125	0.280	0.085	0.091	-0.026	0.020	-0.002
4				1.000	-0.022	0.913	0.105	0.006	0.388	0.207	-0.199	0.396	-0.188	0.131	-0.179	0.092	-0.087	-0.035
5					1.000	-0.087	0.093	0.135	-0.093	-0.145	-0.030	-0.110	0.356	0.101	0.023	0.053	0.129	0.098
6						1.000	0.036	-0.019	0.275	0.150	-0.067	0.297	-0.172	0.069	-0.223	0.148	-0.090	-0.019
7							1.000	0.323	-0.236	-0.151	0.009	-0.239	-0.177	-0.127	-0.032	0.027	-0.077	-0.053
8								1.000	0.034	-0.108	-0.160	0.011	-0.014	0.081	-0.124	-0.074	-0.063	-0.000
9									1.000	0.602	-0.747	0.988	-0.214	0.127	0.097	-0.247	-0.397	-0.474
10										1.000	-0.275	0.605	-0.235	0.018	0.110	-0.224	-0.579	-0.470
11											1.000	-0.717	0.064	-0.056	-0.049	0.204	0.465	0.571
12												1.000	-0.250	0.141	0.112	-0.216	-0.400	-0.470
13													1.000	0.216	0.069	0.360	0.189	0.213
14														1.000	-0.086	0.334	-0.035	0.055
15															1.000	0.244	-0.063	-0.140
16																1.000	0.124	0.163
17																	1.000	0.794
18																		1.000

TABLE XXIV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during July (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 21

Number of 6-Hourly Observations: 213

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	23.28114	7.00525	12 C SLP	10	2.38830	8.02083
LONG	2	130.81773	7.47216	MAX I	11	68.39362	35.91660
12 DIR	3	302.24463	32.31979	MIN 7 HT	12	287.53711	23.30916
12 SPD	4	10.90425	3.27056	7 R LT	13	33.03723	5.48143
24 DIR	5	303.31372	22.65956	7 R HT	14	315.53174	2.92399
24 SPD	6	10.83511	3.08166	7 T LONG	15	114.55318	9.63124
SIZE	7	4.15957	1.88322	7 T HT	16	308.13818	3.45512
12 C SIZ	8	-0.18617	1.06093	12 C I	17	-6.61170	10.52382
SLP	9	974.82446	27.07266	24 C I	18	-6.91489	19.98869

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.078	0.239	-0.097	0.414	-0.100	-0.360	-0.126	-0.085	0.191	-0.042	-0.031	0.863	-0.359	0.078	-0.314	-0.090	-0.206
2		1.000	-0.148	0.032	-0.123	0.010	0.333	0.261	-0.005	-0.270	-0.046	0.014	0.161	0.464	0.306	0.240	0.211	0.168
3			1.000	-0.126	0.582	-0.198	-0.183	-0.007	0.025	0.200	-0.048	0.014	0.104	-0.241	-0.074	-0.006	-0.118	-0.151
4				1.000	-0.170	0.928	0.216	0.058	-0.047	0.072	0.165	-0.053	-0.002	0.434	-0.109	0.126	-0.026	-0.018
5					1.000	-0.278	-0.145	0.042	0.006	0.225	-0.127	0.010	0.283	-0.470	0.078	-0.074	-0.159	-0.228
6						1.000	0.211	0.015	0.014	0.096	0.121	0.013	-0.009	0.445	-0.179	0.158	-0.059	-0.070
7							1.000	0.307	-0.250	0.024	0.085	-0.279	-0.079	0.167	0.008	0.167	0.281	0.213
8								1.000	-0.042	0.051	0.044	-0.037	-0.026	0.098	0.266	0.243	-0.037	-0.001
9									1.000	0.030	-0.856	0.990	-0.118	0.001	-0.006	-0.010	-0.200	-0.283
10										1.000	0.032	0.017	0.163	-0.164	-0.070	0.061	-0.483	-0.461
11											1.000	-0.839	-0.086	0.065	-0.014	-0.030	0.151	0.326
12												1.000	-0.090	-0.015	-0.003	-0.036	-0.219	-0.304
13													1.000	-0.177	0.211	-0.152	-0.021	-0.162
14														1.000	-0.029	0.467	0.042	0.032
15															1.000	0.088	-0.050	0.001
16																1.000	-0.132	-0.103
17																	1.000	0.780
18																		1.000

TABLE XXV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during July (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 322

Variable		Mean	Standard Deviation	Variable	Mean	Standard Deviation
LAT	1	19.59116	6.16035	12 C SLP	-6.93443	7.53344
LONG	2	133.59541	9.03248	MAX I	75.40984	28.44270
12 DIR	3	303.28955	26.72043	MIN 7 HT	290.53540	16.28409
12 SPD	4	11.97814	4.56690	7 R LT	316.86328	3.01787
24 DIR	5	302.37158	25.90388	7 R HT	116.83060	8.55349
24 SPD	6	11.56831	4.26130	7 T LONG	309.15845	3.37930
SIZE	7	3.99454	1.62566	7 T HT	309.15845	3.37930
12 C SIZ	8	-0.07650	0.92857	12 C I	11.17486	9.40077
SLP	9	976.27319	18.88542	24 C I	20.85245	15.30867

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.021	0.498	-0.036	0.501	-0.059	-0.356	-0.022	-0.249	0.013	0.215	-0.213	0.605	-0.225	-0.007	0.110	-0.015	-0.022
2		1.000	0.224	0.374	0.271	0.285	-0.253	-0.117	0.359	0.242	-0.032	0.366	0.262	0.576	0.417	-0.059	0.007	0.020
3			1.000	-0.010	0.901	-0.084	-0.430	-0.075	-0.090	0.060	0.104	-0.042	0.445	0.095	0.287	-0.128	-0.078	-0.115
4				1.000	0.151	0.952	0.029	-0.009	0.020	-0.121	0.258	0.026	-0.047	0.482	0.038	0.122	0.138	0.230
5					1.000	0.055	-0.458	-0.076	-0.090	0.040	0.162	-0.040	0.446	0.194	0.340	-0.081	-0.052	-0.061
6						1.000	0.088	0.029	-0.052	-0.153	0.296	-0.050	-0.126	0.457	-0.013	0.109	0.119	0.207
7							1.000	0.462	-0.030	-0.095	-0.028	-0.109	-0.356	0.128	-0.134	0.080	0.103	0.116
8								1.000	0.037	0.057	0.048	-0.012	-0.062	0.065	-0.112	0.023	0.093	0.062
9									1.000	0.645	-0.750	0.976	0.056	-0.058	0.213	-0.027	-0.353	-0.397
10										1.000	-0.469	0.594	0.163	-0.184	0.328	-0.154	-0.460	-0.486
11											1.000	-0.749	0.015	0.281	-0.032	0.273	0.486	0.581
12												1.000	0.111	-0.079	0.224	-0.090	-0.353	-0.386
13													1.000	-0.021	0.090	-0.160	-0.019	-0.034
14														1.000	0.193	-0.022	0.261	0.289
15															1.000	0.006	-0.116	-0.130
16																1.000	0.089	0.152
17																	1.000	0.857
18																		1.000

TABLE XXVI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during August (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 132

Variable		Mean	Standard Deviation
LAT	1	24.97118	5.37737
LONG	2	130.87978	10.49715
12 DIR	3	305.68066	30.49129
12 SPD	4	11.78723	4.62082
24 DIR	5	304.57446	27.40117
24 SPD	6	11.62766	4.18902
SIZE	7	3.84043	1.99084
12 C SIZ	8	-0.09574	1.12708
SLP	9	971.72339	23.03542
12 C SLP	10	3.67021	9.72233
MAX I	11	80.04254	39.12135
MIN 7 HT	12	285.11694	20.20421
7 R LT	13	34.68085	3.15277
7 R HT	14	114.78723	2.29331
7 T LONG	15	310.17017	8.36381
7 T HT	16	-8.42553	3.21165
12 C I	17	-4.95745	14.81167
24 C I	18	-4.95745	24.25439

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.375	0.411	0.194	0.508	0.176	-0.205	0.146	-0.058	0.099	0.176	-0.049	0.739	-0.065	0.499	-0.205	-0.101	-0.069
2		1.000	0.091	0.175	0.132	0.133	-0.365	-0.006	0.169	-0.225	0.006	0.172	0.387	0.445	0.639	-0.171	0.048	0.126
3			1.000	-0.257	0.905	-0.368	-0.392	-0.004	0.127	0.063	-0.060	0.156	0.102	-0.247	0.145	-0.475	-0.014	0.005
4				1.000	-0.089	0.910	0.165	0.186	-0.086	-0.206	0.048	-0.092	0.330	0.448	0.116	0.071	0.097	0.215
5					1.000	-0.217	-0.385	-0.014	0.119	0.021	-0.080	0.148	0.142	-0.185	0.250	-0.493	-0.035	0.031
6						1.000	0.204	0.170	-0.140	-0.161	0.101	-0.137	0.308	0.465	0.062	0.203	0.055	0.154
7							1.000	0.329	-0.359	-0.053	0.296	-0.416	0.006	0.161	-0.253	0.465	0.182	0.031
8								1.000	-0.139	0.126	0.104	-0.157	0.043	0.062	-0.027	0.132	-0.060	-0.050
9									1.000	0.126	-0.932	0.985	-0.059	-0.100	0.069	-0.350	-0.216	-0.320
10										1.000	-0.153	0.103	0.016	-0.332	-0.111	-0.209	-0.587	-0.586
11											1.000	-0.908	0.176	0.124	0.076	0.287	0.305	0.379
12												1.000	-0.070	-0.093	0.065	-0.381	-0.199	-0.299
13													1.000	0.210	0.253	-0.135	-0.026	-0.046
14														1.000	0.125	0.216	0.126	0.193
15															1.000	-0.032	0.044	0.181
16																1.000	0.152	0.125
17																	1.000	0.799
18																		1.000

TABLE XXVII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during August (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 276

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	18.75757	4.06586	12 C SLP	10	-7.11163	9.20507
LONG	2	135.66890	9.48343	MAX I	11	82.05580	37.28235
12 DIR	3	293.00464	23.13550	MIN 7 HT	12	279.37671	25.81146
12 SPD	4	11.29767	4.60844	7 R LT	13	30.47441	3.78486
24 DIR	5	293.33008	21.78000	7 R HT	14	316.82324	1.98271
24 SPD	6	10.87442	4.30257	7 T LONG	15	119.40930	11.24362
SIZE	7	5.11628	1.90924	7 T HT	16	311.00928	3.18874
12 C SIZ	8	0.17674	1.10496	12 C I	17	11.58605	9.27660
SLP	9	966.18115	29.85680	24 C I	18	22.70697	15.97196

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.103	-0.079	0.249	0.027	0.228	-0.008	-0.015	-0.270	0.058	0.259	-0.258	0.556	-0.113	0.062	0.130	-0.071	-0.046
2		1.000	0.009	0.173	-0.002	0.112	-0.304	0.125	0.149	-0.108	-0.299	0.148	-0.119	0.406	0.473	0.126	0.053	0.060
3			1.000	-0.304	0.927	-0.368	0.055	-0.004	0.004	-0.085	-0.056	-0.019	0.144	-0.088	0.125	-0.208	0.073	0.074
4				1.000	-0.243	0.956	-0.256	-0.098	-0.165	-0.190	0.200	-0.098	0.091	0.215	-0.167	0.151	0.128	0.184
5					1.000	-0.321	0.064	-0.014	0.038	-0.043	-0.088	0.017	0.217	-0.080	0.113	-0.101	0.037	0.045
6						1.000	-0.209	-0.041	-0.247	-0.207	0.287	-0.182	0.094	0.234	-0.230	0.141	0.152	0.211
7							1.000	0.371	-0.189	0.145	0.219	-0.219	0.202	-0.097	-0.106	0.146	0.024	0.015
8								1.000	-0.091	-0.010	0.009	-0.098	0.075	0.110	0.101	0.042	-0.033	-0.058
9									1.000	0.471	-0.923	0.976	-0.284	-0.120	0.121	-0.042	-0.407	-0.475
10										1.000	-0.343	0.411	-0.091	-0.302	0.078	-0.040	-0.557	-0.536
11											1.000	-0.900	0.239	0.051	-0.273	-0.000	0.457	0.550
12												1.000	-0.332	-0.144	0.097	-0.066	-0.374	-0.443
13													1.000	0.083	-0.091	0.234	0.209	0.197
14														1.000	-0.039	0.333	0.289	0.293
15															1.000	0.013	-0.110	-0.103
16																1.000	-0.019	-0.029
17																	1.000	0.876
18																		1.000

TABLE XXVIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during September (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 163

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	22.19196	4.35166	12 C SLP	10	3.62136	8.12829
LONG	2	129.99129	11.09159	MAX I	11	74.83009	45.50163
12 DIR	3	295.23291	27.17735	MIN 7 HT	12	279.39795	26.60837
12 SPD	4	10.67961	4.90535	7 R LT	13	31.71358	3.32183
24 DIR	5	294.30566	24.97586	7 R HT	14	315.11646	1.93704
24 SPD	6	10.33981	4.43390	7 T LONG	15	119.67961	13.00329
SIZE	7	4.48544	2.01390	7 T HT	16	310.23291	3.36321
12 C SIZ	8	-0.14563	0.97187	12 C I	17	-5.53883	7.80148
SLP	9	967.45142	31.82787	24 C I	18	-6.78641	14.72218

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.369	0.424	0.167	0.365	0.192	-0.185	-0.101	0.013	0.087	0.023	0.031	0.752	-0.480	0.267	-0.260	-0.051	-0.076
2		1.000	0.557	0.103	0.594	0.078	-0.312	0.043	0.321	-0.164	-0.288	0.314	0.038	0.120	0.842	-0.383	0.249	0.282
3			1.000	0.003	0.930	-0.031	-0.138	-0.023	0.114	-0.013	-0.013	-0.038	0.096	0.189	-0.282	0.546	-0.307	0.134
4				1.000	-0.083	0.948	-0.013	0.084	0.053	0.157	-0.019	0.076	0.092	0.084	0.109	-0.177	-0.012	0.099
5					1.000	-0.111	-0.144	0.015	0.100	-0.042	-0.042	0.086	0.159	-0.265	0.559	-0.312	0.104	0.125
6						1.000	0.020	0.083	-0.013	0.165	0.034	0.014	0.148	0.089	0.076	-0.141	-0.055	0.053
7							1.000	0.206	-0.459	-0.028	0.486	-0.472	0.122	-0.028	-0.196	0.297	-0.053	0.009
8								1.000	-0.003	-0.084	-0.019	0.005	-0.096	0.022	-0.008	-0.028	-0.021	-0.015
9									1.000	-0.104	-0.930	0.988	-0.082	0.153	0.213	-0.200	0.238	0.072
10										1.000	0.177	-0.086	0.016	-0.180	-0.178	0.030	-0.347	-0.326
11											1.000	-0.938	0.068	-0.184	-0.161	0.161	-0.166	0.019
12												1.000	-0.083	0.137	0.196	-0.210	0.204	0.017
13													1.000	-0.465	-0.039	-0.109	-0.043	-0.035
14														1.000	0.045	0.299	-0.034	0.096
15															1.000	-0.306	0.228	0.258
16																1.000	-0.083	-0.016
17																	1.000	0.738
18																		1.000

TABLE XXIX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during September (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 93

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	15.63125	2.97318	12 C SLP	10	-5.58209	7.88774
LONG	2	130.10814	5.05461	MAX I	11	64.04477	32.55223
12 DIR	3	277.28345	37.10646	MIN 7 HT	12	295.59692	18.96968
12 SPD	4	10.61194	3.80571	7 R LT	13	27.58208	4.41810
24 DIR	5	278.38794	34.56641	7 R HT	14	316.34326	2.00418
24 SPD	6	10.56716	3.89725	7 T LONG	15	121.23880	10.11907
SIZE	7	5.02985	1.84202	7 T HT	16	311.94019	2.00666
12 C SIZ	8	0.43284	1.03314	12 C I	17	10.59701	9.00850
SLP	9	982.67163	24.16002	24 C I	18	19.00000	16.10944

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.125	-0.291	-0.388	-0.256	-0.430	-0.235	-0.122	-0.158	0.023	0.139	-0.166	0.400	-0.052	-0.369	-0.045	-0.116	-0.086
2		1.000	0.251	-0.314	0.269	-0.359	0.257	0.212	-0.534	-0.391	0.364	-0.478	0.460	0.231	0.093	-0.247	0.232	0.291
3			1.000	0.276	0.954	0.324	-0.020	-0.129	-0.375	-0.253	0.235	-0.316	0.037	0.366	0.039	0.185	0.119	0.134
4				1.000	0.264	0.913	-0.450	-0.192	0.399	0.302	-0.361	0.374	-0.291	0.055	-0.080	0.241	-0.142	-0.152
5					1.000	0.305	-0.090	-0.022	-0.287	-0.166	0.129	-0.239	-0.021	0.340	0.131	0.163	0.026	0.043
6						1.000	-0.401	-0.145	0.350	0.268	-0.299	0.373	-0.161	0.258	-0.174	0.411	-0.168	-0.121
7							1.000	0.399	-0.592	-0.519	0.626	-0.536	0.312	0.272	0.142	-0.135	0.538	0.578
8								1.000	-0.002	0.020	-0.028	0.056	0.123	0.205	0.162	-0.141	-0.084	-0.047
9									1.000	0.832	-0.950	0.959	-0.580	-0.476	0.088	0.091	-0.683	-0.797
10										1.000	-0.823	0.859	-0.299	-0.326	0.030	0.287	-0.834	-0.874
11											1.000	-0.935	0.585	0.500	-0.184	-0.082	0.781	0.879
12												1.000	-0.465	-0.329	0.041	0.244	-0.734	-0.820
13													1.000	0.588	-0.384	0.209	0.220	0.363
14														1.000	-0.248	0.325	0.317	0.406
15															1.000	-0.306	-0.113	-0.104
16																1.000	-0.239	-0.158
17																	1.000	0.916
18																		1.000

TABLE XXX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during October (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 26

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	17.82990	6.69193	12 C SLP	10	3.25000	7.40668
LONG	2	135.43945	14.02811	MAX I	11	95.87500	41.02792
12 DIR	3	284.50000	20.14813	MIN 7 HT	12	273.44995	26.81459
12 SPD	4	9.30000	2.87518	7 R LT	13	31.29999	3.83104
24 DIR	5	282.19995	24.09828	7 R HT	14	315.29980	2.65252
24 SPD	6	9.25000	2.53943	7 T LONG	15	121.97499	15.00335
SIZE	7	6.45000	2.68853	7 T HT	16	309.57495	1.76704
12 C SIZ	8	0.20000	1.01779	12 C I	17	-5.10000	6.92005
SLP	9	959.29980	31.67720	24 C I	18	-3.80000	17.72899

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.649	0.548	0.340	0.553	0.311	0.431	-0.257	-0.700	0.181	0.676	-0.668	0.688	-0.726	-0.450	0.591	-0.136	-0.238
2		1.000	-0.294	-0.249	-0.217	-0.213	-0.576	0.112	0.604	-0.089	-0.658	0.533	-0.391	0.762	0.662	-0.482	0.235	0.212
3			1.000	0.487	0.932	0.345	0.430	0.195	-0.594	0.264	0.522	-0.561	0.328	-0.256	-0.019	0.178	-0.145	-0.144
4				1.000	0.551	0.906	0.596	-0.152	-0.652	0.503	0.610	-0.695	-0.101	-0.187	-0.094	-0.020	-0.524	-0.359
5					1.000	0.404	0.542	0.212	-0.686	0.344	0.610	-0.666	0.305	-0.263	0.118	0.220	-0.127	-0.105
6						1.000	0.543	-0.208	-0.556	0.504	0.515	-0.599	-0.242	-0.217	-0.118	-0.021	-0.566	-0.394
7							1.000	0.247	-0.802	0.361	0.801	-0.778	-0.061	-0.616	0.055	0.430	-0.265	-0.176
8								1.000	-0.058	-0.058	0.050	-0.026	-0.200	0.224	0.348	0.020	0.276	0.389
9									1.000	-0.191	-0.987	0.991	-0.266	0.638	0.178	-0.452	0.105	-0.043
10										1.000	0.209	-0.210	0.051	-0.123	-0.031	-0.068	-0.673	-0.645
11											1.000	-0.977	0.285	-0.666	-0.227	0.457	-0.102	0.047
12												1.000	-0.224	0.586	0.150	-0.411	0.104	-0.053
13													1.000	-0.400	-0.396	0.266	0.081	-0.112
14														1.000	0.331	-0.574	0.161	0.220
15															1.000	-0.040	0.250	0.179
16																1.000	0.150	0.056
17																	1.000	0.854
18																		1.000

TABLE XXXI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during October (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 115

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	11.16018	2.65098	12 C SLP	10	-7.31325	7.48154
LONG	2	143.38083	11.90937	MAX I	11	72.95180	36.96675
12 DIR	3	288.38550	22.70209	MIN 7 HT	12	284.91553	22.39072
12 SPD	4	10.34940	3.60362	7 R LT	13	27.44577	5.34253
24 DIR	5	287.87939	20.44765	7 R HT	14	318.00000	2.59924
24 SPD	6	10.27711	3.97648	7 T LONG	15	127.38553	10.57701
SIZE	7	5.63855	1.67898	7 T HT	16	307.43359	4.06108
12 C SIZ	8	0.12048	1.15185	12 C I	17	10.14458	8.57548
SLP	9	973.39746	26.47818	24 C I	18	19.55421	15.85621

Correlation Matrix

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Number	1.000	-0.202	-0.018	0.108	0.025	0.180	-0.087	-0.178	-0.322	-0.148	0.041	-0.301	-0.248	-0.104	-0.276	0.121	-0.083	-0.107
1		1.000	0.123	-0.464	0.207	-0.528	0.414	0.270	0.486	0.438	-0.410	0.443	0.864	0.260	0.615	-0.361	-0.560	-0.574
2			1.000	-0.393	0.932	-0.372	-0.000	0.099	-0.151	-0.042	0.162	-0.132	0.015	-0.506	0.250	0.052	0.278	0.263
3				1.000	-0.380	0.954	0.051	-0.069	0.018	-0.134	0.009	0.015	-0.374	0.130	-0.345	-0.040	0.014	-0.007
4					1.000	-0.389	0.072	0.188	-0.125	-0.031	0.141	-0.109	0.029	-0.469	0.273	-0.035	0.189	0.211
5						1.000	0.026	-0.079	0.005	-0.168	-0.010	0.005	-0.415	0.109	-0.414	-0.018	0.047	0.022
6							1.000	0.319	-0.219	-0.189	0.311	-0.261	0.293	-0.226	0.419	-0.324	-0.089	-0.040
7								1.000	0.208	0.036	-0.163	0.214	0.154	-0.004	0.078	-0.194	-0.207	-0.106
8									1.000	0.663	-0.908	0.983	0.459	0.554	0.248	-0.287	-0.550	-0.620
9										1.000	-0.526	0.610	0.425	0.452	0.298	-0.355	-0.415	-0.435
10											1.000	-0.923	-0.365	-0.499	-0.119	0.143	0.631	0.731
11												1.000	0.409	0.518	0.204	-0.221	-0.498	-0.577
12													1.000	0.352	0.425	-0.198	-0.449	-0.492
13														1.000	-0.104	-0.156	-0.442	-0.462
14															1.000	-0.310	-0.222	-0.240
15																1.000	0.440	0.361
16																	1.000	0.908
17																		1.000
18																		

TABLE XXXII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during November (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 50

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	16.06786	3.52516	12 C SLP	10	3.26415	10.93006
LONG	2	128.54643	6.37001	MAX I	11	89.05659	34.84933
12 DIR	3	281.33960	20.02682	MIN 7 HT	12	269.83008	24.85704
12 SPD	4	10.94340	3.86012	7 R LT	13	25.77357	3.00410
24 DIR	5	283.33960	17.66125	7 R HT	14	316.83008	1.68404
24 SPD	6	11.07547	3.58870	7 T LONG	15	115.86792	9.98657
SIZE	7	5.09434	2.17737	7 T HT	16	308.92432	2.63736
12 C SIZ	8	-0.15094	1.08124	12 C I	17	-5.09434	7.30453
SLP	9	955.60376	28.58072	24 C I	18	-4.24528	13.67181

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.430	0.569	-0.221	0.577	-0.114	-0.054	-0.227	0.076	0.090	-0.251	0.063	0.545	-0.460	-0.630	-0.082	-0.186	-0.563
2		1.000	-0.319	0.175	-0.321	-0.003	0.454	0.219	-0.251	-0.096	0.261	-0.248	0.231	0.236	0.626	-0.063	0.279	0.354
3			1.000	0.185	0.908	0.274	-0.008	-0.334	-0.095	0.027	0.057	-0.096	0.340	-0.308	-0.477	-0.040	-0.113	-0.105
4				1.000	0.036	0.928	0.360	-0.002	-0.244	-0.174	0.155	-0.287	-0.276	0.238	0.216	-0.386	0.201	0.280
5					1.000	0.156	-0.121	-0.330	0.001	0.031	-0.024	0.002	0.341	-0.318	-0.435	0.150	0.062	-0.006
6						1.000	0.317	-0.111	-0.200	-0.105	0.100	-0.254	-0.293	0.184	0.070	-0.375	0.136	0.205
7							1.000	0.341	-0.693	0.029	0.528	-0.715	0.383	-0.022	0.333	-0.658	0.025	-0.025
8								1.000	-0.037	-0.097	-0.050	-0.048	-0.017	0.218	0.488	-0.152	0.108	0.203
9									1.000	0.075	-0.910	0.989	-0.231	0.189	-0.246	0.564	0.037	-0.085
10										1.000	0.090	0.068	0.069	-0.268	-0.157	-0.100	-0.521	-0.443
11											1.000	-0.888	0.069	-0.239	0.349	-0.443	-0.051	0.152
12												1.000	-0.234	0.157	-0.261	0.582	0.031	-0.077
13													1.000	-0.126	-0.206	-0.145	-0.062	-0.288
14														1.000	0.184	0.144	0.202	0.344
15															1.000	-0.145	0.196	0.405
16																1.000	-0.065	0.132
17																	1.000	0.742
18																		1.000

TABLE XXXIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during November (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 21

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	8.56153	1.66561	12 C SLP	10	-9.61538	14.07443
LONG	2	137.73833	5.43184	MAX I	11	124.23076	31.34792
12 DIR	3	286.23071	10.95562	MIN 7 HT	12	263.84595	27.91905
12 SPD	4	15.12077	1.73944	7 R LT	13	21.46153	1.12660
24 DIR	5	284.15481	9.40608	7 R HT	14	315.92285	0.75955
24 SPD	6	15.30769	1.70218	7 T LONG	15	129.23076	7.29330
SIZE	7	5.46154	0.66022	7 T HT	16	299.84595	3.05085
12 C SIZ	8	-0.07692	0.75955	12 C I	17	15.00000	5.00000
SLP	9	944.46143	28.99889	24 C I	18	33.46153	8.26252

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.940	0.918	-0.595	0.967	-0.801	-0.331	0.300	-0.818	0.397	0.963	-0.790	0.854	-0.516	-0.622	-0.219	0.070	0.026
2		1.000	-0.809	0.795	-0.832	0.872	0.555	-0.159	0.933	-0.091	-0.986	0.897	-0.939	0.734	0.571	0.468	-0.226	0.101
3			1.000	-0.427	0.941	-0.782	-0.212	0.373	-0.754	0.433	0.884	-0.740	0.639	-0.458	-0.525	-0.166	0.228	0.267
4				1.000	-0.415	0.847	0.625	-0.049	0.880	0.418	-0.761	0.869	-0.782	0.835	0.468	0.698	-0.479	0.056
5					1.000	-0.706	-0.187	0.317	-0.690	0.562	0.881	-0.656	0.732	-0.348	-0.596	-0.054	-0.035	0.121
6						1.000	0.530	-0.238	0.964	0.082	-0.909	0.966	-0.776	0.793	0.444	0.620	-0.539	-0.289
7							1.000	0.575	0.654	0.428	-0.485	0.578	-0.646	0.741	-0.110	0.783	-0.252	0.065
8								1.000	-0.119	0.369	0.242	-0.256	0.045	0.133	-0.343	0.210	0.219	0.244
9									1.000	0.156	-0.940	0.982	-0.856	0.868	0.404	0.696	-0.517	-0.117
10										1.000	0.157	0.147	0.082	0.533	-0.266	0.673	-0.622	0.152
11											1.000	-0.916	0.896	-0.703	-0.573	-0.437	0.279	0.043
12												1.000	-0.816	0.829	0.381	0.687	-0.570	-0.189
13													1.000	-0.637	-0.420	-0.511	0.074	-0.141
14														1.000	0.229	0.822	-0.658	0.046
15															1.000	-0.257	0.103	0.248
16																1.000	-0.710	-0.142
17																	1.000	0.403
18																		1.000

TABLE XXXIV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during December (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 9

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	13.71111	1.30809	12 C SLP	10	9.44444	7.19567
LONG	2	125.07768	2.43244	MAX I	11	138.88889	40.06071
12 DIR	3	294.22217	2.99073	MIN 7 HT	12	269.00000	10.85127
12 SPD	4	11.33333	1.22474	7 R LT	13	23.55554	1.33333
24 DIR	5	294.66650	4.44410	7 R HT	14	314.00000	1.11803
24 SPD	6	11.77778	1.39443	7 T LONG	15	114.11110	8.25294
SIZE	7	6.11111	0.92796	7 T HT	16	302.33325	1.11803
12 C SIZ	8	0.11111	0.92796	12 C I	17	-12.77778	35.89142
SLP	9	954.22217	14.09590	24 C I	18	-12.77778	46.17297

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.912	0.399	-0.127	0.356	-0.129	0.061	-0.465	0.576	0.335	-0.399	0.670	0.519	-0.538	0.806	-0.781	-0.902	-0.926
2		1.000	-0.118	0.502	0.029	0.511	0.333	0.572	-0.859	0.058	0.684	-0.914	-0.127	0.791	-0.497	0.789	0.753	0.815
3			1.000	0-660	0.712	0.523	0.440	-0.055	-0.247	0.506	0.414	-0.173	0.655	0.336	0.647	-0.212	-0.419	-0.276
4				1.000	0.781	0.927	0.843	0.403	-0.845	0.747	0.798	-0.781	0.714	0.822	0.441	0.274	-0.047	0.074
5					1.000	0.834	0.859	0.404	-0.509	0.834	0.405	-0.417	0.900	0.327	0.812	-0.252	-0.563	-0.468
6						1.000	0.891	0.504	-0.862	0.808	0.767	-0.801	0.747	0.722	0.459	0.294	-0.051	0.028
7							1.000	0.419	-0.748	0.909	0.643	-0.670	0.853	0.602	0.618	0.080	-0.271	-0.196
8								1.000	-0.595	0.085	0.105	-0.621	0.045	0.241	-0.100	0.080	0.085	0.154
9									1.000	-0.532	-0.847	0.991	-0.393	-0.896	-0.015	-0.584	-0.364	-0.459
10										1.000	0.585	-0.424	0.961	0.466	0.788	-0.005	-0.411	-0.387
11											1.000	-0.825	0.458	0.949	0.087	0.693	0.404	0.485
12												1.000	-0.276	-0.886	0.106	-0.639	-0.461	-0.555
13													1.000	0.335	0.914	-0.224	-0.604	-0.550
14														1.000	-0.041	0.700	0.467	0.569
15															1.000	-0.573	-0.864	-0.824
16																1.000	0.898	0.868
17																	1.000	0.973
18																		1.000

TABLE XXXV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during December (1960-1969) for the period after maximum intensity.

APPENDIX C

Statistical calculations of the 18 available parameters of the recurving tropical storms and typhoons during the period 1960-1969 are presented. Computations are shown for the two composited periods of the recurving storms: before and after the point of recurvature.

Each table presents (1) the number of tropical storms and typhoons for the period, (2) the number of six-hourly observations during the period, (3) the means and standard deviations of the 18 parameters, and (4) a correlation matrix of the 18 variables.

Number of Recurving Tropical Storms and Typhoons: 68

Number of 6-Hourly Observations: 1252

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	18.36998	5.76564	12 C SLP	10	-4.12897	9.28970
LONG	2	142.70726	10.26473	MAX I	11	82.67450	37.16492
12 DIR	3	312.28247	39.53185	MIN 7 HT	12	279.84839	23.56303
12 SPD	4	9.38280	4.21954	7 R LAT	13	29.02866	5.37998
24 DIR	5	307.87695	43.44450	7 R HT	14	315.72046	2.74565
24 SPD	6	9.24156	4.04324	7 T LONG	15	128.13817	12.34497
SIZE	7	5.20778	2.10837	7 T HT	16	306.86060	5.59121
12 C SIZ	8	0.14227	1.10843	12 C I	17	5.71238	11.24244
SLP	9	966.25366	27.13858	24 C I	18	12.66735	18.67787

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.041	0.197	-0.088	0.186	-0.086	-0.118	-0.063	-0.203	0.152	0.189	-0.209	0.759	-0.128	-0.021	0.382	-0.236	-0.245
2		1.000	-0.141	0.135	-0.068	0.086	-0.161	0.062	0.180	-0.041	-0.189	0.167	0.126	0.293	0.505	-0.178	0.076	0.082
3			1.000	-0.200	0.716	-0.223	-0.027	0.021	-0.033	0.043	-0.000	-0.038	0.034	-0.217	-0.025	0.037	-0.076	-0.071
4				1.000	-0.138	0.942	-0.119	-0.056	-0.102	0.026	0.113	-0.096	0.015	0.413	-0.036	-0.062	-0.032	-0.021
5					1.000	-0.150	-0.011	-0.024	-0.003	0.036	-0.035	-0.005	0.057	-0.160	-0.050	0.078	-0.060	-0.062
6						1.000	-0.130	-0.067	-0.110	0.026	0.124	-0.103	0.000	0.413	-0.049	-0.073	-0.058	-0.042
7							1.000	0.303	-0.338	-0.053	0.331	-0.305	-0.019	-0.196	-0.019	0.013	0.002	0.017
8								1.000	0.004	-0.130	0.008	0.016	-0.042	0.006	0.025	-0.033	0.095	0.127
9									1.000	0.173	-0.931	0.982	-0.195	0.063	0.087	-0.090	0.005	-0.084
10										1.000	-0.127	0.134	0.074	-0.050	0.002	0.010	-0.645	-0.641
11											1.000	-0.919	0.178	-0.039	-0.085	0.050	0.076	0.177
12												1.000	-0.199	0.069	0.073	-0.086	0.015	-0.075
13													1.000	0.132	-0.064	0.487	-0.134	-0.141
14														1.000	-0.132	0.064	0.066	0.078
15															1.000	-0.161	0.042	0.041
16																1.000	-0.040	-0.052
17																	1.000	0.871
18																		1.000

TABLE XXXVI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons for all months (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 68

Number of 6-Hourly Observations: 723

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	26.73586	6.55985	12 C SLP	10	3;78939	8.16806
LONG	2	141.68881	8.88711	MAX I	11	72.58635	28.87628
12 DIR	3	42.51363	52.93779	MIN 7 HT	12	284.00903	18.32323
12 SPD	4	13.58182	9.73094	7 R LAT	13	34.19394	6.68204
24 DIR	5	73.40150	107.24602	7 R HT	14	310.88013	4.25780
24 SPD	6	12.07121	8.17845	7 T LONG	15	131.53333	12.79126
SIZE	7	5.11515	2.40674	7 T HT	16	305.10449	13.22460
12 C SIZ	8	-0.10152	21.63503	12 C I	17	-5.47576	11.65301
SLP	9	970.94385	8.16806	24 C I	18	-8.06667	20.09506

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.290	0.023	0.517	-0.132	0.552	-0.155	-0.014	0.029	0.306	-0.008	-0.000	0.799	-0.372	0.169	0.104	-0.318	-0.355
2		1.000	0.036	0.432	-0.129	0.471	0.101	0.001	0.139	0.094	-0.205	0.134	0.298	-0.262	0.641	-0.051	-0.115	-0.141
3			1.000	0.024	0.268	0.031	-0.101	0.016	0.102	-0.065	-0.072	0.082	0.011	0.024	-0.125	0.011	0.074	0.040
4				1.000	-0.137	0.976	0.116	-0.078	0.066	0.324	-0.019	0.039	0.311	-0.595	0.333	-0.137	-0.372	-0.391
5					1.000	-0.142	-0.022	0.037	-0.125	-0.106	0.167	-0.140	-0.148	0.149	-0.135	-0.073	0.141	0.138
6						1.000	0.086	-0.096	0.087	0.331	-0.046	0.062	0.341	-0.594	0.339	-0.136	-0.376	-0.393
7							1.000	0.282	-0.281	-0.001	0.247	-0.258	0.041	-0.301	0.223	-0.140	0.015	0.027
8								1.000	0.002	-0.042	-0.042	0.019	0.044	0.050	0.003	0.016	0.023	0.047
9									1.000	0.056	-0.876	0.978	-0.049	0.143	-0.045	-0.000	-0.021	-0.109
10										1.000	0.079	-0.008	0.148	-0.210	0.141	-0.009	-0.599	-0.600
11											1.000	-0.891	0.015	-0.178	-0.035	-0.031	0.074	0.154
12												1.000	-0.049	0.163	-0.043	0.013	0.002	-0.084
13													1.000	-0.251	0.064	0.150	-0.180	-0.196
14														1.000	-0.386	0.231	0.214	0.210
15															1.000	-0.076	-0.164	-0.176
16																1.000	0.033	0.039
17																	1.000	0.817
18																		1.000

TABLE XXXVII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons for all months (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 17

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	11.85555	1.65009	12 C SLP	10	-1.55556	1.42400
LONG	2	136.84428	4.00106	MAX I	11	40.00000	3.53553
12 DIR	3	307.88867	24.49716	MIN 7 HT	12	305.66650	1.74005
12 SPD	4	10.55556	7.38429	7 R LAT	13	20.55554	1.01379
24 DIR	5	301.00000	11.45644	7 R HT	14	315.44434	8.01561
24 SPD	6	12.88889	7.68837	7 T LONG	15	131.66666	6.18016
SIZE	7	5.22222	0.97183	7 T HT	16	296.00000	1.00000
12 C SIZ	8	0.66667	1.32288	12 C I	17	2.77778	6.18016
SLP	9	999.33325	3.31662	24 C I	18	7.77778	9.71825

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.742	-0.300	0.441	-0.411	0.467	-0.032	0.067	0.723	0.467	0.525	-0.581	0.876	-0.667	0.923	-0.348	-0.452	-0.486
2		1.000	-0.544	0.921	-0.287	0.921	-0.562	-0.009	0.969	0.387	0.844	-0.093	0.915	-0.150	0.931	0.275	0.032	0.189
3			1.000	-0.545	0.737	-0.701	0.421	0.107	-0.520	0.159	-0.281	0.376	-0.485	-0.169	-0.532	-0.464	0.308	-0.043
4				1.000	-0.109	0.974	-0.664	0.047	0.869	0.176	0.862	0.213	0.722	0.163	0.732	0.592	0.277	0.533
5					1.000	-0.295	0.146	0.223	-0.388	-0.199	0.170	0.557	-0.464	0.054	-0.415	0.142	0.512	0.449
6						1.000	-0.649	0.045	0.884	0.142	0.782	0.087	0.743	0.200	0.760	0.602	0.126	0.448
7							1.000	0.648	-0.608	-0.442	-0.546	-0.309	-0.452	-0.240	-0.326	-0.386	-0.636	-0.537
8								1.000	-0.085	-0.509	0.0	0.105	-0.127	0.217	0.012	0.283	0.408	0.081
9									1.000	0.547	0.746	-0.042	0.939	-0.087	0.889	0.188	0.071	0.162
10										1.000	0.248	0.016	0.594	-0.327	0.387	-0.527	0.268	-0.191
11											1.000	0.098	0.711	-0.174	0.728	0.354	0.286	0.364
12												1.000	-0.292	0.707	-0.424	0.485	0.823	0.844
13													1.000	-0.370	0.947	-0.072	-0.103	-0.140
14														1.000	-0.441	0.740	0.377	0.747
15															1.000	-0.000	-0.269	-0.171
16																1.000	0.303	0.836
17																	1.000	0.740
18																		1.000

TABLE XXXVIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during January (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 26

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	15.20765	4.05453	12 C SLP	10	0.61538	1.65111
LONG	2	140.07294	6.05479	MAX I	11	35.19231	12.28664
12 DIR	3	59.07692	20.34286	MIN 7 HT	12	307.30762	2.75346
12 SPD	4	12.23077	8.58048	7 R LT	13	20.65384	3.03239
24 DIR	5	80.69231	80.91547	7 R HT	14	313.69214	3.46144
24 SPD	6	10.69231	6.93264	7 T LONG	15	137.30768	6.25312
SIZE	7	5.11538	1.21085	7 T HT	16	293.73071	3.96542
12 C SIZ	8	-0.30769	0.83758	12 C I	17	-1.34615	7.00823
SLP	9	999.53833	2.95609	24 C I	18	-1.34615	11.18549

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.916	0.048	0.965	-0.169	0.964	-0.889	-0.368	-0.121	-0.118	0.530	-0.431	0.852	-0.955	0.787	-0.741	-0.315	-0.232
2		1.000	0.271	0.897	-0.163	0.927	-0.878	-0.361	0.222	-0.031	0.218	-0.077	0.692	-0.791	0.937	-0.474	-0.363	-0.347
3			1.000	0.094	-0.397	0.200	-0.108	-0.168	0.661	0.352	-0.543	0.563	-0.345	0.097	0.425	0.272	-0.309	-0.402
4				1.000	-0.161	0.982	-0.842	-0.313	-0.108	0.012	0.404	-0.408	0.775	-0.946	0.822	-0.767	-0.404	-0.403
5					1.000	-0.216	0.203	0.288	-0.011	-0.033	0.024	-0.025	-0.009	0.113	-0.220	0.091	0.214	0.150
6						1.000	-0.882	-0.396	-0.064	-0.004	0.365	-0.349	0.754	-0.918	0.843	-0.723	-0.421	-0.390
7							1.000	0.428	0.116	0.063	-0.391	0.373	-0.784	0.810	-0.723	0.632	0.420	0.248
8								1.000	0.150	0.126	-0.035	0.181	-0.390	0.283	-0.218	0.311	-0.005	-0.153
9									1.000	[illegible]	[illegible]	-0.134	0.214	[illegible]	[illegible]	[illegible]	-0.002	-0.237
[illegible]																		

TABLE XXXIX. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during January (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 40

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	12.76247	2.91456	12 C SLP	10	-1.37500	11.49964
LONG	2	136.98096	2.36855	MAX I	11	88.46875	33.17497
12 DIR	3	327.03125	33.90543	MIN 7 HT	12	284.50000	18.35666
12 SPD	4	6.71875	2.41279	7 R LT	13	20.28125	2.63027
24 DIR	5	288.15625	97.95517	7 R HT	14	315.50000	1.29515
24 SPD	6	6.78125	2.48524	7 T LONG	15	125.68750	9.09249
SIZE	7	5.31250	0.69270	7 T HT	16	296.68750	6.43296
12 C SIZ	8	0.0	0.87988	12 C I	17	2.81250	15.34848
SLP	9	972.06250	21.96025	24 C I	18	9.03125	21.53836

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.695	0.724	-0.415	0.108	-0.589	-0.416	-0.307	-0.447	0.685	0.509	-0.402	0.700	0.038	-0.047	0.725	-0.715	-0.739
2		1.000	-0.633	0.413	0.006	0.527	0.057	0.293	0.790	-0.302	-0.837	0.760	-0.119	-0.390	-0.333	-0.198	0.344	0.320
3			1.000	-0.733	-0.107	-0.853	-0.410	-0.396	-0.603	0.229	0.605	-0.607	0.311	-0.232	-0.123	0.359	-0.213	-0.260
4				1.000	0.167	0.915	0.267	0.243	0.596	0.040	-0.553	0.625	-0.175	0.191	0.112	-0.172	-0.089	-0.032
5					1.000	0.113	-0.015	-0.267	0.193	0.034	-0.203	0.246	0.152	-0.186	-0.369	0.200	-0.190	-0.104
6						1.000	0.341	0.266	0.683	-0.057	-0.661	0.693	-0.207	0.256	0.215	-0.386	0.010	0.052
7							1.000	0.635	0.128	-0.244	-0.067	0.117	-0.298	0.252	0.375	-0.397	0.355	0.280
8								1.000	0.115	-0.086	-0.081	0.092	-0.014	0.255	0.274	-0.160	0.268	0.182
9									1.000	0.140	-0.981	0.992	0.130	-0.349	-0.227	-0.099	-0.121	-0.149
10										1.000	-0.024	0.170	0.739	0.095	0.064	0.544	-0.885	-0.901
11											1.000	-0.971	-0.075	0.376	0.250	0.170	0.066	0.072
12												1.000	0.156	-0.341	-0.233	-0.020	-0.174	-0.188
13													1.000	-0.033	-0.135	0.642	-0.727	-0.820
14														1.000	0.690	-0.248	-0.097	-0.082
15															1.000	-0.569	-0.049	-0.052
16																1.000	-0.518	-0.563
17																	1.000	0.947
18																		1.000

TABLE XL. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during March (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 24

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	18.20830	3.06607	12 C SLP	10	2.95833	4.64831
LONG	2	145.99988	5.36666	MAX I	11	42.70833	7.27400
12 DIR	3	45.83333	26.80469	MIN 7 HT	12	306.83325	4.23921
12 SPD	4	9.20833	4.21156	7 R LT	13	23.62500	2.58444
24 DIR	5	42.66666	26.42406	7 R HT	14	311.16650	2.46129
24 SPD	6	8.54167	2.79719	7 T LONG	15	131.00000	12.03256
SIZE	7	4.75000	1.39096	7 T HT	16	293.45825	7.34242
12 C SIZ	8	-0.25000	1.22474	12 C I	17	-5.75000	11.56926
SLP	9	1000.25000	4.83869	24 C I	18	-13.12500	24.69695

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.262	-0.508	0.120	-0.473	-0.021	-0.754	-0.379	0.899	0.297	-0.905	0.891	0.841	0.558	0.787	-0.312	-0.285	-0.449
2		1.000	-0.139	-0.529	0.144	-0.283	-0.203	-0.192	0.200	-0.734	-0.215	-0.039	0.243	-0.216	0.738	-0.916	0.590	0.670
3			1.000	0.345	0.889	0.405	0.244	0.032	-0.183	-0.115	0.305	-0.232	-0.519	-0.301	-0.343	0.336	0.333	0.133
4				1.000	0.290	0.857	-0.043	-0.074	0.407	0.529	-0.303	0.513	0.247	0.580	-0.167	0.652	-0.371	-0.658
5					1.000	0.457	0.311	0.069	-0.130	-0.304	0.291	-0.245	-0.376	-0.210	-0.124	0.128	0.439	0.312
6						1.000	0.081	-0.048	0.349	0.316	-0.244	0.360	0.276	0.599	-0.066	0.451	-0.195	-0.452
7							1.000	0.625	-0.649	-0.190	0.736	-0.664	-0.499	-0.343	-0.621	0.169	0.193	0.324
8								1.000	-0.407	-0.124	0.431	-0.368	-0.333	-0.130	-0.434	0.270	0.124	0.192
9									1.000	0.368	-0.913	0.960	0.856	0.683	0.754	-0.176	-0.255	-0.544
10										1.000	-0.335	0.547	0.274	0.559	-0.141	0.615	-0.882	-0.942
11											1.000	-0.904	-0.783	-0.621	-0.738	0.191	0.357	0.534
12												1.000	0.816	0.749	0.602	0.044	-0.439	-0.718
13													1.000	0.789	0.723	-0.300	-0.250	-0.450
14														1.000	0.349	0.253	-0.522	-0.717
15															1.000	-0.703	0.060	0.023
16																1.000	-0.477	-0.594
17																	1.000	0.813
18																		1.000

TABLE XLI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during March (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 62

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	12.42217	3.28016	12 C SLP	10	-1.94444	6.58304
LONG	2	142.40457	11.05612	MAX I	11	60.83333	26.25615
12 DIR	3	302.94434	22.85588	MIN 7 HT	12	293.22217	19.16133
12 SPD	4	10.62963	5.62103	7 R LT	13	22.83333	3.14882
24 DIR	5	300.92578	20.30412	7 R HT	14	315.94434	1.72021
24 SPD	6	10.57407	5.09754	7 T LONG	15	126.66666	3.69168
SIZE	7	4.50000	1.41087	7 T HT	16	303.64795	3.69168
12 C SIZ	8	0.01852	1.22074	12 C I	17	4.35185	9.21679
SLP	9	982.16650	21.81892	24 C I	18	9.25926	13.64672

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.760	0.698	-0.517	0.656	-0.477	-0.265	-0.047	-0.300	0.326	0.635	-0.317	0.611	-0.175	-0.577	-0.081	-0.310	-0.290
2		1.000	-0.325	0.272	-0.263	0.192	0.457	0.076	-0.134	-0.180	-0.276	-0.135	-0.295	0.063	0.580	-0.114	0.102	0.118
3			1.000	-0.822	0.918	-0.779	0.099	0.048	-0.468	0.102	0.634	-0.451	0.389	-0.464	-0.254	-0.104	-0.164	-0.086
4				1.000	-0.866	0.944	-0.395	-0.054	0.465	0.153	-0.640	0.433	-0.154	0.566	0.307	-0.159	-0.123	-0.160
5					1.000	-0.879	0.227	0.102	-0.494	0.125	0.652	-0.482	0.362	-0.542	-0.263	-0.083	-0.144	-0.066
6						1.000	-0.429	-0.020	0.491	0.150	-0.663	0.469	-0.158	0.589	0.250	-0.134	-0.165	-0.213
7							1.000	0.422	-0.422	-0.464	0.258	-0.396	-0.214	-0.136	0.101	0.132	0.316	0.372
8								1.000	0.176	0.049	-0.195	0.202	-0.225	-0.062	0.263	-0.099	-0.007	-0.107
9									1.000	0.214	-0.865	0.992	-0.665	-0.107	0.266	0.103	0.010	-0.121
10										1.000	-0.069	0.159	0.240	-0.061	0.031	-0.441	-0.443	-0.517
11											1.000	-0.865	0.724	-0.011	-0.486	-0.004	0.070	0.206
12												1.000	-0.679	-0.104	0.273	0.122	0.069	-0.084
13													1.000	0.280	-0.357	-0.299	-0.244	-0.168
14														1.000	0.036	-0.131	0.123	0.139
15															1.000	-0.338	0.040	0.008
16																1.000	0.367	0.433
17																	1.000	0.787
18																		1.000

TABLE XLII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during April (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 20

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	20.56995	1.03777	12 C SLP	10	5.70000	4.01444
LONG	2	138.36493	9.56104	MAX I	11	52.75000	17.43216
12 DIR	3	11.00000	15.28673	MIN 7 HT	12	299.29980	11.08863
12 SPD	4	2.35000	2.75824	7 R LT	13	27.14999	2.30046
24 DIR	5	23.00000	80.81613	7 R HT	14	314.25000	1.83174
24 SPD	6	4.25000	1.94327	7 T LONG	15	131.45000	10.28783
SIZE	7	4.00000	1.02598	7 T HT	16	-8.75000	9.85086
12 C SIZ	8	-0.25000	0.96655	12 C I	17	-10.00000	30.60785
SLP	9	987.50000	13.93783	24 C I	18	-10.00000	30.60785

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.036	0.272	0.430	-0.165	-0.534	-0.331	-0.265	0.724	-0.132	-0.872	0.695	0.434	-0.004	0.013	0.033	-0.068	-0.082
2		1.000	0.078	-0.591	-0.341	0.048	0.203	-0.310	-0.524	0.533	0.231	-0.470	0.800	0.856	0.668	0.934	0.526	0.372
3			1.000	0.137	0.019	0.041	-0.238	-0.313	0.123	-0.140	-0.182	0.172	-0.033	-0.028	0.043	0.134	0.157	0.141
4				1.000	0.401	-0.047	-0.409	-0.143	0.628	-0.223	-0.437	0.550	-0.307	-0.633	-0.618	-0.579	-0.492	-0.218
5					1.000	0.010	-0.095	0.257	0.204	0.172	0.324	0.160	-0.320	-0.220	-0.396	-0.340	0.157	0.191
6						1.000	0.106	0.147	-0.695	0.037	0.553	-0.727	-0.244	-0.181	-0.038	-0.168	-0.196	0.164
7							1.000	0.690	-0.493	0.460	0.338	-0.472	-0.000	-0.000	0.703	0.240	0.234	0.277
8								1.000	-0.150	0.142	0.246	-0.184	-0.385	-0.379	0.245	-0.379	0.117	0.098
9									1.000	-0.343	-0.760	0.973	-0.093	-0.316	-0.449	-0.416	-0.193	-0.264
10										1.000	0.377	-0.361	0.404	0.297	0.439	0.532	0.576	0.593
11											1.000	-0.712	-0.195	0.233	0.153	0.160	0.316	0.338
12												1.000	-0.113	-0.232	-0.370	-0.342	-0.179	-0.210
13													1.000	0.728	0.468	0.758	0.282	0.116
14														1.000	0.474	0.831	0.507	0.197
15															1.000	0.675	0.446	0.349
16																1.000	0.538	0.312
17																	1.000	0.441
18																		1.000

TABLE XLIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during April (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 47

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	17.10803	3.35547	12 C SLP	10	-7.08108	13.31952
LONG	2	132.16711	2.35967	MAX I	11	80.27026	28.35648
12 DIR	3	320.62158	24.39299	MIN 7 HT	12	283.21606	18.64450
12 SPD	4	9.18919	3.90752	7 R LT	13	25.59459	1.97849
24 DIR	5	315.32422	22.55367	7 R HT	14	315.37817	2.37289
24 SPD	6	9.29730	3.87201	7 T LONG	15	121.64864	9.16277
SIZE	7	4.08108	2.11316	7 T HT	16	308.70264	2.54804
12 C SIZ	8	0.16216	0.98639	12 C I	17	9.86486	16.97571
SLP	9	971.24316	21.17046	24 C I	18	19.18918	24.13829

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.694	0.458	0.000	0.423	0.018	-0.643	-0.300	-0.412	0.172	0.373	-0.389	-0.207	-0.520	-0.105	-0.337	-0.289	-0.297
2		1.000	-0.612	0.391	-0.569	0.365	0.215	0.167	0.249	-0.195	-0.257	0.237	-0.115	0.737	0.616	0.507	0.197	0.209
3			1.000	-0.531	0.983	-0.631	0.018	0.171	-0.354	-0.181	0.312	-0.379	0.096	-0.820	-0.201	-0.649	0.068	-0.038
4				1.000	-0.514	0.955	0.129	-0.232	-0.322	-0.332	0.293	-0.353	0.308	0.657	0.379	0/525	0.352	0.362
5					1.000	-0.628	0.068	0.224	-0.341	-0.212	0.289	-0.369	0.090	-0.810	-0.237	-0.649	0.126	0.024
6						1.000	0.041	-0.340	-0.315	-0.279	0.286	-0.325	0.216	0.698	0.364	0.522	0.271	0.325
7							1.000	0.407	-0.070	-0.551	0.069	-0.125	0.692	0.271	-0.217	0.036	0.608	0.568
8								1.000	0.414	-0.033	-0.419	0.358	0.063	0.056	-0.239	-0.036	0.059	-0.053
9									1.000	0.602	-0.957	0.988	-0.240	0.264	-0.240	0.444	-0.563	-0.571
10										1.000	-0.482	0.623	-0.373	-0.144	-0.258	0.108	-0.802	-0.690
11											1.000	-0.945	0.257	-0.264	0.201	-0.501	0.554	0.586
12												1.000	-0.304	0.257	-0.239	0.411	-0.594	-0.591
13													1.000	0.187	-0.128	0.146	0.333	0.226
14														1.000	0.347	0.708	0.070	0.088
15															1.000	0.275	0.071	0.004
16																1.000	-0.171	-0.230
17																	1.000	0.918
18																		1.000

TABLE XLIV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during June (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 37

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	26.31897	4.26709	12 C SLP	10	5.69048	8.61876
LONG	2	134.52092	4.48241	MAX I	11	72.45238	34.18614
12 DIR	3	32.73808	17.43005	MIN 7 HT	12	284.23804	21.73656
12 SPD	4	13.47619	6.64881	7 R LT	13	32.30951	3.97852
24 DIR	5	71.19048	107.48877	7 R HT	14	311.28564	3.23310
24 SPD	6	12.19048	5.53145	7 T LONG	15	119.52380	10.64329
SIZE	7	4.28571	1.71486	7 T HT	16	306.73804	3.72898
12 C SIZ	8	-0.04762	1.12515	12 C I	17	-8.57143	12.54482
SLP	9	972.92847	24.02983	24 C I	18	-12.14286	28.46696

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.846	0.666	0.850	-0.260	0.851	0.378	0.014	0.247	0.324	-0.295	0.287	0.902	-0.739	0.601	-0.515	-0.489	-0.625
2		1.000	0.820	0.786	-0.270	0.800	0.327	-0.040	0.189	0.205	-0.230	0.217	0.815	-0.735	0.314	-0.378	-0.325	-0.388
3			1.000	0.464	-0.484	0.473	-0.007	-0.017	0.458	0.148	-0.424	0.464	0.695	-0.386	-0.005	0.079	-0.118	-0.247
4				1.000	-0.157	0.979	0.512	-0.108	-0.107	0.319	0.056	-0.070	0.679	-0.888	0.643	-0.782	-0.470	-0.480
5					1.000	-0.181	-0.157	0.014	-0.005	-0.202	0.042	-0.033	-0.394	0.077	0.074	-0.026	0.259	0.217
6						1.000	0.547	-0.089	-0.161	0.378	0.122	-0.123	0.712	-0.907	0.652	-0.765	-0.536	-0.495
7							1.000	0.349	-0.587	0.214	0.494	-0.546	0.373	-0.591	0.617	-0.629	-0.459	-0.334
8								1.000	-0.015	0.202	0.009	0.002	-0.084	-0.003	0.183	0.183	-0.294	-0.298
9									1.000	-0.046	-0.966	0.993	0.185	0.136	-0.359	0.374	0.133	-0.235
10										1.000	0.110	0.025	0.175	-0.444	0.185	-0.227	-0.736	-0.746
11											1.000	-0.970	-0.238	-0.105	0.313	-0.281	-0.077	0.288
12												1.000	0.214	0.092	-0.331	0.334	0.050	-0.321
13													1.000	-0.565	0.461	-0.359	-0.307	-0.420
14														1.000	-0.550	0.795	0.622	0.576
15															1.000	-0.650	-0.415	-0.348
16																1.000	0.455	0.396
17																	1.000	0.860
18																		1.000

TABLE XLV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during June (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 49

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	24.46999	5.26751	12 C SLP	10	-3.40000	5.98516
LONG	2	136.10991	10.22012	MAX I	11	56.79999	22.70486
12 DIR	3	337.09985	12.50288	MIN 7 HT	12	298.29980	11.46056
12 SPD	4	10.70000	8.52512	7 R LT	13	33.00000	3.05505
24 DIR	5	329.89990	11.95779	7 R HT	14	317.29980	1.15950
24 SPD	6	10.20000	7.28468	7 T LONG	15	99.00000	9.03081
SIZE	7	3.40000	0.51640	7 T HT	16	303.79980	4.02216
12 C SIZ	8	0.0	0.81650	12 C I	17	6.50000	9.25262
SLP	9	989.79980	13.77437	24 C I	18	15.80000	16.58513

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.928	0.022	0.804	-0.166	0.960	0.185	-0.256	0.911	0.975	-0.918	0.831	0.975	0.693	-0.510	-0.534	-0.857	0.985
2		1.000	-0.269	0.901	-0.476	0.935	0.448	0.052	0.924	0.930	-0.961	0.846	0.954	0.834	-0.269	-0.372	-0.839	-0.919
3			1.000	-0.409	0.957	-0.166	-0.730	-0.697	-0.324	-0.084	0.347	-0.396	-0.052	-0.608	-0.336	0.025	-0.041	-0.085
4				1.000	-0.575	0.919	0.560	0.192	0.830	0.884	-0.883	0.769	0.811	0.741	-0.367	-0.511	-0.818	-0.803
5					1.000	-0.336	-0.749	-0.637	-0.465	-0.263	0.505	-0.489	-0.268	-0.743	-0.303	0.032	0.171	0.116
6						1.000	0.331	-0.131	0.931	0.988	-0.945	0.866	0.934	0.755	-0.495	-0.594	-0.841	-0.938
7							1.000	0.791	0.434	0.309	-0.495	0.848	0.211	0.520	0.095	-0.171	-0.256	-0.171
8								1.000	-0.030	-0.182	-0.048	0.047	-0.223	0.117	0.377	0.203	0.103	0.222
9									1.000	0.922	-0.989	0.979	0.892	0.888	-0.392	-0.578	-0.686	-0.847
10										1.000	-0.934	0.846	0.954	0.724	-0.543	-0.613	-0.875	-0.953
11											1.000	-0.955	-0.911	-0.880	0.372	0.541	0.754	0.874
12												1.000	0.787	0.870	-0.373	-0.604	-0.553	-0.751
13													1.000	0.753	-0.395	-0.425	-0.884	-0.963
14														1.000	-0.011	-0.295	-0.482	-0.609
15															1.000	0.912	0.525	0.490
16																1.000	0.454	0.462
17																	1.000	0.902
18																		1.000

TABLE XLVI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during July (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 60

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	26.39998	7.01227	12 C SLP	10	-3.00000	4.12310
LONG	2	134.29079	9.79011	MAX I	11	78.18181	37.93629
12 DIR	3	28.09090	13.33757	MIN 7 HT	12	284.27271	21.33115
12 SPD	4	7.45455	7.50151	7 R LT	13	35.63635	2.97566
24 DIR	5	21.36363	17.72159	7 R HT	14	315.45435	1.29334
24 SPD	6	7.00000	5.01996	7 T LONG	15	105.36363	10.83764
SIZE	7	3.63636	0.50452	7 T HT	16	307.72705	4.19740
12 C SIZ	8	0.27273	0.46710	12 C I	17	5.45455	5.27946
SLP	9	974.36353	25.14069	24 C I	18	10.00000	11.07249

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.995	-0.435	0.756	-0.394	0.995	-0.537	-0.031	0.967	0.806	-0.956	0.958	0.827	0.517	-0.807	-0.960	-0.844	-0.988
2		1.000	-0.429	0.725	-0.452	0.995	-0.578	-0.041	0.982	0.792	-0.972	0.975	0.835	0.590	-0.842	-0.978	-0.831	-0.988
3			1.000	-0.216	0.682	-0.439	0.466	0.301	-0.457	-0.500	0.418	-0.445	-0.012	-0.078	0.317	0.492	0.457	0.494
4				1.000	-0.080	0.775	-0.586	-0.267	0.676	0.540	-0.681	0.668	0.608	0.337	-0.561	-0.628	-0.670	-0.731
5					1.000	-0.420	0.710	0.059	-0.577	-0.155	0.574	-0.590	-0.174	-0.667	0.672	0.596	0.388	0.496
6						1.000	-0.592	-0.085	0.970	0.807	-0.958	0.961	0.817	0.554	-0.818	-0.963	-0.860	-0.984
7							1.000	0.463	-0.659	-0.288	0.657	-0.659	-0.230	-0.641	0.722	0.657	0.444	0.591
8								1.000	-0.001	-0.363	-0.054	0.032	0.294	0.105	-0.140	0.042	-0.055	-0.000
9									1.000	0.697	-0.996	0.999	0.793	0.665	-0.922	-0.994	-0.801	-0.979
10										1.000	-0.643	0.664	0.554	0.131	-0.385	-0.734	-0.684	-0.749
11											1.000	-0.999	-0.813	-0.695	0.942	0.983	0.788	0.975
12												1.000	0.799	0.684	-0.935	-0.990	-0.796	-0.976
13													1.000	0.645	-0.712	-0.753	-0.682	-0.813
14														1.000	-0.798	-0.638	-0.429	-0.580
15															1.000	0.897	0.638	0.848
16																1.000	0.796	0.970
17																	1.000	0.835
18																		1.000

TABLE XLVII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during July (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 12

Number of 6-Hourly Observations: 211

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	23.90071	4.50846	12 C SLP	10	-3.24193	8.03073
LONG	2	141.67549	9.56844	MAX I	11	73.91934	32.83086
12 DIR	3	332.07251	39.30473	MIN 7 HT	12	287.75806	17.40538
12 SPD	4	9.21774	3.49345	7 R LT	13	33.76613	3.47606
24 DIR	5	330.69336	41.81898	7 R HT	14	316.92725	2.58566
24 SPD	6	9.12903	3.13118	7 T LONG	15	112.92741	10.17658
SIZE	7	4.03226	1.43099	7 T HT	16	309.44336	4.60522
12 C SIZ	8	0.08871	1.10440	12 C I	17	4.47581	11.59506
SLP	9	974.24170	21.33408	24 C I	18	9.75806	19.94760

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.147	-0.085	0.040	-0.117	0.143	-0.202	-0.174	-0.262	0.236	0.227	-0.292	0.610	-0.066	0.324	0.073	-0.297	-0.313
2		1.000	-0.085	-0.093	-0.018	-0.115	-0.216	0.028	0.186	0.038	-0.008	0.185	0.154	0.498	0.318	-0.395	0.018	0.041
3			1.000	-0.376	0.940	-0.339	-0.078	0.036	0.232	0.056	-0.250	0.159	-0.237	-0.329	-0.243	0.197	-0.026	-0.058
4				1.000	-0.386	0.882	0.033	-0.064	-0.225	0.067	0.167	-0.224	0.093	0.224	0.080	0.133	-0.216	-0.154
5					1.000	-0.391	-0.076	0.024	0.260	0.045	-0.274	0.181	-0.244	-0.288	-0.246	0.183	-0.015	-0.054
6						1.000	0.010	-0.121	-0.264	0.109	0.179	-0.269	0.099	0.200	0.149	0.156	-0.257	-0.215
7							1.000	0.353	-0.408	0.008	0.380	-0.405	0.191	0-192	-0.384	0.072	-0.057	-0.037
8								1.000	0.026	-0.142	-0.004	0.038	-0.094	-0.012	0.009	-0.070	0.129	0.141
9									1.000	0.165	-0.926	0.983	-0.285	-0.184	0.169	0.223	-0.055	-0.149
10										1.000	-0.112	0.131	0.061	-0.027	-0.024	0.028	-0.710	-0.683
11											1.000	-0.918	0.290	0.178	-0.165	-0.418	0.124	0.220
12												1.000	-0.304	-0.155	0.195	0.152	-0.051	-0.143
13													1.000	0.316	-0.021	0.086	-0.102	-0.090
14														1.000	-0.134	-0.256	-0.110	0.148
15															1.000	0.058	0.164	0.148
16																1.000	-0.032	-0.050
17																	1.000	0.889
18																		1.000

TABLE XLVIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during August (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 12

Number of 6-Hourly Observations: 201

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	31.71289	5.53769	12 C SLP	10	2.00000	6.15640
LONG	2	141.94594	9.19308	MAX I	11	64.32520	24.61108
12 DIR	3	36.86179	32.28651	MIN 7 HT	12	290.53638	11.93368
12 SPD	4	10.69106	5.42931	7 R LT	13	38.02438	3.33255
24 DIR	5	58.27641	88.87680	7 R HT	14	312.37378	3.48390
24 SPD	6	9.94309	4.82870	7 T LONG	15	128.69917	12.34336
SIZE	7	3.61789	1.73921	7 T HT	16	309.13818	3.36159
12 C SIZ	8	0.00813	1.05190	12 C I	17	-2.83740	9.51730
SLP	9	978.82104	14.41250	24 C I	18	-3.21138	16.80951

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.511	0.364	0.540	0.056	0.585	-0.107	0.087	-0.194	0.364	0.132	-0.251	0.739	-0.550	0.352	0.028	-0.342	-0.405
2		1.000	0.363	0.449	0.016	0.482	0.446	0.261	0.279	0.117	-0.264	0.249	0.529	-0.083	0.649	0.306	-0.138	-0.199
3			1.000	0.357	0.061	0.368	0.030	0.014	0.199	0.059	-0.161	0.158	0.427	-0.237	0.095	0.104	-0.024	-0.149
4				1.000	-0.014	0.964	0.005	0.104	0.106	0.395	0.046	0.067	0.444	-0.321	0.137	0.116	-0.368	-0.341
5					1.000	0.013	-0.076	-0.003	-0.129	-0.118	0.122	-0.124	0.018	0-087	-0.004	0.193	0.225	0.133
6						1.000	-0.015	0.097	0.136	0.373	0.002	0.097	0.491	-0.353	0.173	0.108	-0.370	-0.383
7							1.000	0.418	-0.017	-0.058	-0.067	0.009	0.064	0.233	0.308	0.041	0.033	0.083
8								1.000	-0.084	-0.105	0.122	-0.041	0.065	0.053	0.251	0.204	0.178	0.258
9									1.000	0.149	-0.839	0.979	0.077	0.232	0.172	0.258	-0.115	-0.226
10										1.000	-0.080	0.112	0.174	-0.242	0.119	-0.176	-0.557	-0.565
11											1.000	-0.820	-0.173	-0.208	-0.192	-0.268	0.247	0.405
12												1.000	0.034	0.273	0.151	0.255	-0.107	-0.205
13													1.000	-0.327	0.096	0.024	-0.261	-0.389
14														1.000	-0.320	0.581	0.240	0.258
15															1.000	0.089	-0.185	-0.187
16																1.000	0.026	0.043
17																	1.000	0.840
18																		1.000

TABLE XLIX. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during August (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 13

Number of 6-Hourly Observations: 267

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	21.07358	4.90181	12 C SLP	10	-3.80233	10.62675
LONG	2	144.03882	11.06972	MAX I	11	91.80620	40.26518
12 DIR	3	302.49129	36.37802	MIN 7 HT	12	272.34106	25.05725
12 SPD	4	9.17442	4.20351	7 R LT	13	32.58139	3.77724
24 DIR	5	300.51147	33.84894	7 R HT	14	315.41846	3.47798
24 SPD	6	8.88760	4.00180	7 T LONG	15	130.86433	12.83960
SIZE	7	5.09690	1.85313	7 T HT	16	309.33325	3.78575
12 C SIZ	8	0.12791	1.16828	12 C I	17	4.69767	11.19547
SLP	9	958.08521	28.91414	24 C I	18	10.89147	19.39482

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.033	0.228	-0.203	0.233	-0.230	0.084	-0.064	0.022	0.311	-0.063	-0.000	0.518	-0.522	0.211	-0.042	-0.410	-0.477
2		1.000	-0.163	0.059	-0.125	0.030	-0.286	0.020	0.199	-0.053	-0.134	0.149	0.138	0.322	0.566	-0.146	0.124	0.126
3			1.000	0.176	0.942	0.143	0.192	0.092	-0.112	0.158	0.064	-0.065	-0.131	-0.192	0.190	-0.212	-0.210	-0.222
4				1.000	0.166	0.969	-0.156	-0.054	-0.228	0.052	0.253	-0.195	0.145	0.546	-0.165	-0.124	-0.175	-0.132
5					1.000	0.139	0.212	0.059	-0.105	0.170	0.060	-0.052	-0.142	-0.203	0.221	-0.248	-0.217	-0.229
6						1.000	-0.129	-0.059	-0.270	0.048	0.297	-0.230	0.157	0.561	-0.178	-0.051	-0.200	-0.163
7							1.000	0.318	-0.369	-0.013	0.373	-0.301	0.114	-0.308	0.018	0.021	-0.073	-0.024
8								1.000	-0.035	-0.199	0.049	-0.006	-0.083	0.007	-0.046	-0.013	0.130	0.205
9									1.000	0.129	-0.941	0.968	-0.247	0.035	0.172	-0.217	0.150	0.054
10										1.000	-0.093	0.065	0.175	-0.048	0.090	0.017	-0.519	-0.592
11											1.000	-0.923	0.248	-0.017	-0.093	0.203	-0.014	0.079
12												1.000	-0.284	0.021	0.151	-0.219	0.162	0.071
13													1.000	-0.030	-0.036	0.171	-0.337	-0.334
14														1.000	-0.150	0.080	0.038	0.059
15															1.000	-0.047	01005	-0.015
16																1.000	-0.086	-0.084
17																	1.000	0.867
18																		1.000

TABLE L. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during September (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 13

Number of 6-Hourly Observations: 73

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	28.30338	4.99942	12 C SLP	10	3.56522	7.10336
LONG	2	138.43097	7.21560	MAX I	11	71.04347	26.92244
12 DIR	3	32.90434	21.30763	MIN 7 HT	12	37.56522	17.83984
12 SPD	4	10.97391	5.95959	7 R LT	13	311.00000	5.54744
24 DIR	5	71.03477	107.23669	7 R HT	14	128.46956	3.23086
24 SPD	6	9.86957	5.32870	7 T LONG	15	308.00000	11.36342
SIZE	7	5.06087	2.00125	7 T HT	16	-5.06087	3.79518
12 C SIZ	8	-0.05217	1.25547	12 C I	17	-5.06087	11.51752
SLP	9	968.79980	19.91917	24 C I	18	-8.62609	14.62238

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.477	-0.044	0.690	-0.108	0.765	-0.191	-0.108	0.093	0.068	-0.082	0.105	0.645	-0.395	-0.010	-0.273	-0.151	-0.163
2		1.000	0.231	0.265	-0.102	0.310	-0.186	0.033	0.362	-0.060	-0.338	0.381	0.331	0.003	0.415	-0.184	0.015	0.030
3			1.000	0.015	-0.213	-0.004	-0.033	0.105	0.177	-0.048	-0.166	0.182	-0.027	-0.028	0.200	-0.113	-0.066	0.040
4				1.000	-0.083	0.959	-0.129	-0.092	0.129	-0.036	-0.155	0.140	0.639	-0.467	0.067	-0.413	-0.042	-0.044
5					1.000	-0.070	-0.028	-0.045	-0.181	0.038	0.140	-0.141	-0.187	0.140	-0.010	-0.073	-0.094	-0.087
6						1.000	-0.238	-0.126	0.150	-0.018	-0.177	0.167	0.640	-0.425	0.049	-0.385	-0.048	-0.032
7							1.000	0.312	-0.365	0.224	0.407	-0.420	0.269	-0.351	0.151	-0.273	-0.195	-0.337
8								1.000	0.018	-0.008	-0.064	0.019	0.003	-0.013	0.089	0.096	-0.152	-0.122
9									1.000	-0.216	-0.884	0.976	0.075	0.096	0.042	0.072	0.240	0.436
10										1.000	0.377	-0.332	0.099	-0.010	0.036	0.077	-0.433	-0.461
11											1.000	-0.901	-0.022	-0.068	-0.076	-0.008	-0.079	-0.298
12												1.000	0.072	0.144	0.030	0.077	0.263	0.467
13													1.000	-0.413	-0.053	-0.265	-0.139	-0.209
14														1.000	-0.307	0.698	0.088	0.139
15															1.000	-0.538	0.007	0.015
16																1.000	-0.023	0.030
17																	1.000	0.726
18																		1.000

TABLE LI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during September (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 20

Number of 6-Hourly Observations: 322

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	18.68286	4.55629	12 C SLP	10	-5.22266	8.47231
LONG	2	143.31659	9.61878	MAX I	11	82.01172	33.53586
12 DIR	3	311.64063	40.09172	MIN 7 HT	12	279.53516	23.47285
12 SPD	4	8.49609	3.29347	7 R LT	13	28.88672	4.29393
24 DIR	5	308.08594	37.30464	7 R HT	14	315.67188	2.36677
24 SPD	6	8.41406	3.22738	7 T LONG	15	130.45313	10.47930
SIZE	7	6.00781	2.38620	7 T HT	16	307.44922	4.93378
12 C SIZ	8	0.18359	1.07442	12 C I	17	6.57813	10.67855
SLP	9	965.94141	26.41660	24 C I	18	14.41016	17.49673

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.226	0.271	0.105	0.250	0.064	0.009	-0.085	-0.353	0.087	0.356	-0.354	0.744	-0.136	0.057	0.271	-0.138	-0.085
2		1.000	-0.014	0.320	-0.068	0.279	-0.382	0.079	0.153	-0.079	-0.225	0.162	0.331	0.370	0.494	-0.210	0.076	0.105
3			1.000	-0.203	0.921	-0.221	0.129	-0.039	-0.127	-0.036	0.117	-0.158	0.107	-0.168	0.074	0.112	-0.028	0.017
4				1.000	-0.207	0.938	-0.107	0.025	-0.173	0.024	0.146	-0.182	0.157	0.250	0.262	-0.276	0.035	0.049
5					1.000	-0.235	0.165	-0.058	-0.122	-0.040	0.128	-0.162	0.090	-0.172	-0.005	0.123	0.007	0.044
6						1.000	-0.136	0.011	-0.153	0.023	0.110	-0.167	0.110	0.225	0.241	-0.291	0.005	0.022
7							1.000	0.275	-0.277	0.006	0.352	-0.230	0.090	-0.225	-0.309	0.212	-0.003	0.028
8								1.000	-0.079	-0.157	0.117	-0.065	-0.012	0.155	-0.036	0.049	0.207	0.278
9									1.000	0.215	-0.925	0.985	-0.104	0.261	0.013	0.038	-0.055	-0.170
10										1.000	-0.205	0.171	0.117	-0.142	-0.003	0.044	-0.725	-0.703
11											1.000	-0.916	0.122	-0.256	-0.040	0.021	0.157	0.297
12												1.000	-0.089	0.262	-0.026	0.053	-0.039	-0.158
13													1.000	0.226	-0.125	0.450	-0.124	-0.118
14														1.000	-0.001	0.182	0.197	0.196
15															1.000	-0.351	0.014	0.046
16																1.000	-0.082	-0.089
17																	1.000	0.854
18																	.	1.000

TABLE LII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during October (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 20

Number of 6-Hourly Observations: 190

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	26.85971	5.82878	12 C SLP	10	4.09804	9.72167
LONG	2	144.69905	8.52349	MAX I	11	83.41176	25.42378
12 DIR	3	37.00000	31.60600	MIN 7 HT	12	276.02930	17.56808
12 SPD	4	15.26961	9.67498	7 R LT	13	35.49019	6.17111
24 DIR	5	67.35294	98.85736	7 R HT	14	309.95093	4.22606
24 SPD	6	13.39706	8.21765	7 T LONG	15	137.42155	10.12129
SIZE	7	6.06863	2.60827	7 T HT	16	305.70093	5.60464
12 C SIZ	8	-0.11275	1.09725	12 C I	17	-5.60294	12.77013
SLP	9	960.89697	20.73518	24 C I	18	-7.59804	21.43607

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.537	0.019	0.791	-0.200	0.817	0.008	0.011	0.311	0.560	-0.200	0.205	0.728	-0.498	0.459	-0.440	-0.626	-0.654
2		1.000	0.054	0.381	-0.044	0.425	-0.080	0.060	0.093	0.240	-0.183	0.019	0.427	-0.201	0.696	-0.155	-0.247	-0.281
3			1.000	-0.084	-0.092	-0.060	-0.285	-0.052	0.034	0.100	-0.083	0.024	-0.096	-0.057	0.141	0.178	-0.084	-0.145
4				1.000	-0.232	0.981	-0.009	0.003	0.329	0.361	-0.206	0.245	0.476	-0.613	0.280	-0.490	-0.463	-0.433
5					1.000	-0.245	-0.040	0.002	-0.053	-0.046	0.120	-0.084	-0.250	0.184	0.041	0.143	0.084	0.097
6						1.000	-0.019	0.001	0.351	0.385	-0.252	0.275	0.519	-0.617	0.302	-0.521	-0.486	-0.464
7							1.000	0.325	-0.154	-0.115	0.218	-0.095	0.285	-0.218	-0.101	-0.140	0.121	0.154
8								1.000	0.044	-0.077	-0.147	0.072	0.083	-0.016	0.013	-0.023	0.081	0.062
9									1.000	0.203	-0.816	0.960	0.285	-0.035	0.027	-0.152	-0.196	-0.288
10										1.000	-0.008	0.089	0.317	-0.161	0.282	-0.131	-0.677	-0.704
11											1.000	-0.838	-0.238	-0.115	-0.059	0.077	0.173	0.268
12												1.000	0.253	0.013	-0.035	-0.160	-0.110	-0.207
13													1.000	-0.319	0.190	-0.448	-0.436	-0.423
14														1.000	-0.255	0.640	0.210	0.175
15															1.000	-0.167	-0.311	-0.367
16																1.000	0.222	0.186
17																	1.000	0.887
18																		1.000

TABLE LIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during October (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 198

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	14.09690	4.08195	12 C SLP	10	-4.37349	8.48766
LONG	2	142.70528	9.42299	MAX I	11	85.31325	42.11461
12 DIR	3	313.94556	48.12259	MIN 7 HT	12	276.06006	24.69048
12 SPD	4	10.84337	4.81155	7 R LT	13	25.54819	4.21476
24 DIR	5	307.96973	56.42902	7 R HT	14	315.43970	2.64102
24 SPD	6	10.54217	4.72080	7 T LONG	15	126.03613	12.62070
SIZE	7	5.57831	2.38743	7 T HT	16	305.39746	4.70831
12 C SIZ	8	0.15663	1.13331	12 C I	17	6.92771	10.96356
SLP	9	961.18066	28.70543	24 C I	18	15.21084	19.18544

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.359	0.176	0.115	0.078	0.205	-0.184	0.050	-0.419	0.107	0.453	-0.402	0.526	-0.078	-0.244	0.141	-0.198	-0.149
2		1.000	-0.093	-0.002	0.046	-0.080	-0.105	0.163	0.408	-0.073	-0.447	0.393	-0.110	0.368	0.409	-0.318	0.148	0.129
3			1.000	-0.337	0.529	-0.392	-0.274	0.047	0.012	-0.028	-0.088	-0.004	0.179	-0.421	0.111	0.105	-0.024	0.003
4				1.000	-0.243	0.933	-0.135	-0.159	-0.143	-0.057	0.227	-0.142	-0.060	0.580	-0.284	0.185	0.118	0.088
5					1.000	-0.238	-0.202	-0.079	-0.006	0.016	-0.066	-0.009	-0.004	-0.218	0.063	-0.005	-0.009	-0.035
6						1.000	-0.150	-0.160	-0.181	-0.034	0.282	-0.178	-0.007	0.565	-0.316	0.179	0.075	0.087
7							1.000	0.280	-0.398	0.070	0.349	-0.386	0.001	-0.159	0.068	-0.118	-0.173	-0.190
8								1.000	0.054	-0.062	-0.055	0.062	0.038	-0.114	0.108	-0.073	-0.100	-0.096
9									1.000	0.044	-0.952	0.991	-0.120	-0.081	0.295	0.040	0.109	-0.006
10										1.000	-0.019	0.021	0.025	-0.016	-0.074	0.075	-0.654	-0.603
11											1.000	-0.944	0.104	0.120	-0.314	0.059	-0.025	0.107
12												1.000	-0.114	-0.064	0.301	0.046	0.119	-0.002
13													1.000	0.072	-0.115	0.225	0.028	0.024
14														1.000	-0.194	-0.078	0.163	0.159
15															1.000	-0.324	0.121	0.130
16																1.000	0.023	-0.008
17																	1.000	0.866
18																		1.000

TABLE LIV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during November (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 73

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	26.18938	5.70006	12 C SLP	10	7.75000	9.52346
LONG	2	141.76480	10.31071	MAX I	11	86.32893	24.87425
12 DIR	3	35.77631	23.55902	MIN 7 HT	12	278.05249	15.63657
12 SPD	4	21.85526	14.90741	7 R LT	13	31.82893	4.97295
24 DIR	5	88.75000	122.73222	7 R HT	14	308.51294	6.06957
24 SPD	6	18.52631	12.97016	7 T LONG	15	131.00000	14.27907
SIZE	7	5.17105	2.27676	7 T HT	16	299.76294	34.64336
12 C SIZ	8	-0.27632	1.16159	12 C I	17	-10.42105	11.33987
SLP	9	964.25000	18.96599	24 C I	18	-17.52631	17.06569

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.683	0.793	0.909	-0.366	0.917	0.043	-0.282	0.589	0.371	-0.592	0.560	0.671	-0.570	0.605	0.074	-0.390	-0.616
2		1.000	0.572	0.638	-0.234	0.662	-0.129	-0.278	0.413	-0.096	-0.589	0.457	0.632	-0.456	0.736	0.029	-0.074	-0.188
3			1.000	0.734	-0.304	0.751	0.051	-0.318	0.494	0.304	-0.463	0.490	0.499	-0.668	0.663	-0.035	-0.341	-0.444
4				1.000	-0.257	0.983	0.110	-0.193	0.441	0.349	-0.451	0.403	0.566	-0.517	0.655	0.022	-0.355	-0.568
5					1.000	-0.222	0.093	0.085	-0.348	-0.187	0.367	-0.357	-0.374	0.162	-0.261	-0.247	0.249	0.295
6						1.000	0.099	-0.265	0.457	0.310	-0.449	0.410	0.575	-0.532	0.636	0.019	-0.315	-0.533
7							1.000	0.109	-0.520	-0.013	0.579	-0.554	-0.181	-0.445	0.096	-0.224	0.090	0.013
8								1.000	-0.110	0.038	0.042	-0.078	-0.131	0.253	-0.234	-0.009	-0.106	-0.039
9									1.000	0.455	-0.813	0.978	0.412	-0.088	0.187	0.214	-0.390	-0.549
10										1.000	-0.216	0.408	0.065	-0.206	0.075	0.080	-0.500	-0.531
11											1.000	-0.854	-0.616	0.059	-0.391	-0.208	0.498	0.578
12												1.000	0.441	-0.066	0.230	0.249	-0.416	-0.531
13													1.000	-0.398	0.528	0.118	-0.145	-0.221
14														1.000	-0.672	0.109	0.030	0.103
15															1.000	0.085	-0.130	-0.230
16																1.000	-0.104	-0.106
17																	1.000	0.766
18																		1.000

TABLE LV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during November (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 39

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	11.65482	3.47798	12 C SLP	10	-4.16129	9.37762
LONG	2	153.98349	10.60255	MAX I	11	88.70967	32.45425
12 DIR	3	295.35474	17.34460	MIN 7 HT	12	288.00000	19.68585
12 SPD	4	11.32258	2.74939	7 R LT	13	25.41934	2.91861
24 DIR	5	294.16113	13.88302	7 R HT	14	315.12891	2.26188
24 SPD	6	11.29032	2.61015	7 T LONG	15	139.64516	11.97092
SIZE	7	5.29032	1.32145	7 T HT	16	296.96753	5.57065
12 C SIZ	8	0.29032	0.97274	12 C I	17	6.45161	3.01440
SLP	9	975.16113	20.83760	24 C I	18	13.38710	5.68434

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	-0.086	0.112	-0.195	0.384	0.282	0.282	0.138	-0.911	-0.150	0.895	-0.922	0.379	0.257	-0.662	0.000	-0.059	-0.029
2		1.000	0.065	-0.099	0.188	-0.378	-0.354	-0.197	0.889	0.135	-0.852	0.893	-0.375	-0.246	0.649	-0.079	0.057	0.036
3			1.000	-0.687	0.906	-0.669	0.289	0.249	0.228	0.085	-0.366	0.124	-0.196	-0.617	0.331	-0.229	-0.396	-0.422
4				1.000	-0.597	0.874	-0.118	-0.335	-0.034	0.159	0.229	0.020	0.319	0.513	-0.456	0.538	0.373	0.376
5					1.000	-0.692	0.190	0.228	0.385	0.120	-0.484	0.264	-0.196	-0.667	0.311	-0.240	-0.195	-0.366
6						1.000	0.004	-0.336	-0.360	-0.148	0.465	-0.258	0.408	0.620	-0.593	0.537	0.316	0.336
7							1.000	0.684	-0.072	-0.079	-0.045	-0.050	-0.292	-0.180	-0.349	0.110	-0.406	-0.646
8								1.000	0.012	0.100	-0.072	-0.040	-0.361	-0.381	-0.065	-0.287	-0.421	-0.485
9									1.000	0.343	-0.940	0.972	-0.387	-0.431	0.500	-0.034	-0.040	-0.134
10										1.000	-0.129	0.242	-0.140	0.001	0.130	-0.068	-0.307	-0.114
11											1.000	-0.947	0.418	0.470	-0.571	-0.037	0.022	0.155
12												1.000	-0.417	-0.325	0.480	0.073	0.015	-0.089
13													1.000	0.194	-0.186	0.198	0.266	0.354
14														1.000	-0.168	-0.559	0.242	0.302
15															1.000	-0.073	-0.110	-0.045
16																1.000	0.491	0.377
17																	1.000	0.745
18																		1.000

TABLE LVI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during December (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 19

Variable		Mean	Standard Deviation	Variable		Mean	Standard Deviation
LAT	1	20.07364	4.73636	12 C SLP	10	0.68421	6.28978
LONG	2	147.77357	6.23930	MAX I	11	71.05263	40.36565
12 DIR	3	51.26315	20.51514	MIN 7 HT	12	283.47363	20.04817
12 SPD	4	19.84210	11.87557	7 R LT	13	27.15788	4.23297
24 DIR	5	40.84210	27.10934	7 R HT	14	308.63135	4.04434
24 SPD	6	16.36841	10.18283	7 T LONG	15	141.89473	5.92447
SIZE	7	9.00000	3.05505	7 T HT	16	299.31567	5.28154
12 C SIZ	8	0.0	1.20185	12 C I	17	-5.21316	11.95752
SLP	9	967.63135	22.59105	24 C I	18	-5.52632	19.28548

Correlation Matrix

Variable Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.690	-0.121	0.915	0.216	0.909	-0.291	-0.340	-0.138	0.613	0.146	-0.089	0.902	-0.596	0.733	-0.233	-0.750	-0.669
2		1.000	0.160	0.896	0.480	0.908	0.336	-0.030	0.531	0.433	-0.594	0.612	0.818	-0.894	0.863	0.496	-0.386	-0.309
3			1.000	0.053	0.706	0.057	-0.063	0.020	0.125	-0.07	-0.328	0.260	-0.032	-0.042	0.149	0.383	-0.319	-0.369
4				1.000	0.455	0.988	-0.025	-0.261	0.156	0.504	-0.205	0.238	0.896	-0.772	0.856	0.144	-0.630	-0.557
5					1.000	0.425	0.044	-0.247	0.180	0.125	-0.330	0.303	0.234	-0.322	0.482	0.435	-0.266	-0.314
6						1.000	-0.046	-0.277	0.150	0.507	-0.215	0.242	0.920	-0.760	0.861	0.183	-0.654	-0.573
7							1.000	0.635	0.942	-0.038	-0.838	0.879	-0.026	-0.535	0.181	0.599	0.654	0.698
8								1.000	0.610	-0.059	-0.498	0.549	-0.153	-0.274	-0.008	0.123	0.329	0.360
9									1.000	0.114	-0.942	0.978	0.150	-0.673	0.336	0.706	0.429	0.496
10										1.000	0.051	0.056	0.584	-0.483	0.503	-0.243	-0.367	-0.256
11											1.000	-0.983	-0.142	0.622	-0.358	-0.864	-0.293	-0.326
12												1.000	0.207	-0.701	0.406	0.793	0.309	0.369
13													1.000	-0.749	0.838	0.025	-0.608	-0.499
14														1.000	-0.832	-0.356	0.210	0.090
15															1.000	0.193	-0.479	-0.411
16																1.000	0.278	0.283
17																	1.000	0.975
18																		1.000

TABLE LVII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during December (1960-1969) for the period after the point of recurvature.

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13. ABSTRACT

Six-hourly observations containing 18 parameters of tropical storms and typhoons in the western north Pacific Ocean during the period 1960 through 1969 were examined. The data were composited into four periods: before and after maximum intensity for East-West moving storms, and before and after recurvature for recurving storms.

Monthly and seasonal variations of tropical cyclone intensity, speed of movement and size were examined. Correlation coefficients of the 18 tropical storm and typhoon parameters were computed for each of the four composited periods of study. The four highest correlation values for the past 24-hour change of intensity parameter were checked for levels of significance.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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